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EXPLORATION IN PAPUA.

By the Hon. MILES STANIFORTH SMITH, Administrator of the Territory of Papua.

At the present day few territories of the world remain totally unexplored, and the fascination of wresting from Nature its jealously guarded secrets has concentrated attention on those areas to a greater extent even than to those larger regions that are only partially or superficially explored. The many difficulties of exploration in Papua have frequently been mentioned by lecturers before this great Society—a Society whose magnificent achievements in stimulating exploration and geographical research have laid the whole world under a debt of gratitude.

Except in the neighbourhood of its navigable rivers, the interior of New Guinea presents many difficulties to the explorer. Generally speaking, the country is rugged and mountainous, and covered with thick jungle and scrub, through which tracks have to be laboriously cut. The character of the country renders travelling very slow, while the thick jungle so impedes the vision that a comprehensive survey of the general lie of the country is rarely possible. In our recent expedition we were unable, often for days together, to obtain a view of more than a few chains ahead of us, and, relying solely on the compasses, had to cut blindly on like moles burrowing underground. This disability precluded us from choosing a route that might have avoided many natural obstacles and difficulties; while, doubtless, we often passed close to native villages, at which food supplies might have been obtained, without knowing of their existence. When we commenced the ascent of a spur of Mount Murray, we believed we were passing over a hillock a few hundred feet in height, whereas,

* Royal Geographical Society, February 12, 1912. Map, p. 420.

after four days' climbing, we found we had reached an elevation of 8000 feet, and were, I believe, on the highest mountain in the Western Division, with the sole exception of the main range on the northern boundary of the territory. In such localities plane-table work is impossible, and a hurried trigonometrical survey, however rough, is rarely practicable, as a view of the surrounding country can only be obtained at rare intervals.

Another difficulty which confronts the explorer is the paucity of population in the interior of Western Papua, as the small and scattered native villages can only occasionally supply sufficient food for a small party. Any expedition with a large number of carriers must rely almost solely upon the food supplies carried, unless where sago forests are continuous, and this is rarely the case, and can never be relied upon in traversing a new country. In attempting to penetrate overland into the unexplored interior of Western Papua with a large party, it will be found, unless sago is available, that the food supplies are so exhausted in two weeks as to necessitate the return of the expedition. The ordinary food carried is rice and tinned meat. A native carrier is heavily loaded in such country if he carries a 50-lb. mat of rice, which he himself will consume in a month, at the rate of 1½ lbs. a day. When, in addition to this, tinned meat, tents, flys, camp gear, and trade goods, however economically provided, have to be included, the food supplies cannot last more than three weeks, and, after cutting inland for a fortnight, at least a week must be allowed to return to the base.

Confronted with the difficulties I have outlined, it appeared to me evident that any exploring party which desires to traverse the unknown territory of Western Papua must, in order to overcome the great natural difficulties, reduce its numbers to an absolute minimum, consistent with safety, and discard all impedimenta not absolutely necessary for efficiency. In other words, it should be a purely exploring expedition, and should not be accompanied by a scientific staff of naturalists, geologists, and botanists, with their instruments, collecting-boxes, chemicals, etc., necessitating a large staff of carriers.

The white personnel should be limited to three—a leader, an officer to look after the native police and carriers, and a thoroughly qualified surveyor who can take such observations and bearings as will ensure the production of a trustworthy map of the route traversed. With ten armed native constables, and, if possible, as few as seventeen picked carriers making thirty in all, the party is mobile, easily handled, and the native villages encountered are often able to supply two or three days' food in exchange for "trade."

In travelling in new country the price of safety is constant vigilance, unless when in positions so inaccessible that a night attack is impossible. Our guard, changed every two hours, was always stationed with instructions to fire in the air if any native was seen or heard. We slept

with our loaded revolvers in our belts or at our sides. The rate of progress of an expedition is regulated by the speed of its slowest member, and a large party is slower, less easily handled, and more liable to create delay in rough and unknown country than a small force.

An expedition into Dutch New Guinea, led by Dr. Max Moszkowski, returned in January last after penetrating to the source of the Mamberamo river. The success of the undertaking was attributed to the fact that the party (which included only one scientific assistant) was a very small one. When a lightly-equipped expedition has accomplished its task and prepared a map showing the nature of the country traversed, the positions of the mountain ranges, rivers, watersheds, villages, and sago forests, it is possible for a large scientific expedition to reach any given point of the route traversed by easier and more expeditious routes, and with a knowledge as to where food supplies can be found, and with information as to whether the local natives are friendly or hostile.

To overcome the difficulty of food supply as far as possible, it was decided to carry, in addition to the ordinary rations, a quantity of concentrated foods sufficient, with occasional supplies of sago, to feed a small party of police and carriers for one month. These foods were, in most instances, in sealed tins, and, as an additional security, were packed in oiled canvas bags to resist the heavy rains and damp climate.

The expedition which I led started inland from the head of the navigable waters of the Kikor or Aird river, with the intention of travelling in a northerly direction until we reached Mount Murray, situated a little beyond the most westerly point attained by the Mackay-Little expedition two years previously, and from there to strike westerly with the object of searching for coal deposits on the upper waters of the gulf rivers. It was believed, by adopting this course, it would be possible, should food supplies become depleted, to quickly reach the coast by descending one of the large rivers.

The party, at the commencement of the expedition, numbered 75 (5 whites, 20 armed constables, and 50 carriers). These carriers conveyed our baggage and sufficient ordinary stores to last three weeks. In fourteen days we had reached the top of Mount Murray. At this point Mr. Hennelly, the resident magistrate of the Gulf Division, and Mr. Murray, Private Secretary, with fourteen police and thirty-three carriers, returned to the depôt on the Kikor river and thence to the coast, with directions to obtain fresh supplies and explore the upper waters of the Turama river in a steam launch as far as it was navigable. The area of unexplored country, traversed by Messrs. Hennelly and Leonard Murray, and later on by Judge Herbert and Mr. Murray, is shown on the map.

Mr. Bell, Chief Inspector of Native Affairs, and Mr. Pratt, Staff Surveyor, with eleven native police and seventeen carriers, remained with me. We had a week's ordinary rations and twenty-three loads of concentrated foods which the police had carried, and for which they were paid

carriers' wages in addition to their ordinary salaries. By these means we were able to penetrate 50 miles inland, and were then better equipped with food supplies than an ordinary expedition is at the commencement of its journey.

Descending this range in a north-westerly direction, we came to a large fertile valley at an elevation of 6000 feet above sea-level, watered by the Sambregi creek, and containing a population of at least a thousand people. Here we bought a village pig, and were given access to a large sweet potato field. In the midst of such plenty we rested for a day, as the carriers were feeling the effects of their chilling experience on Mount Murray, where the temperature had been as low as 55°.

On December 10 we travelled down to the Sambregi creek, the direction being a little north of west. On the fourth day we found it joined a larger branch from the north. Following this in a westerly direction, we found, to our surprise, this fair-sized river thundered into a huge cave or tunnel; on continuing our march we found the river reappear some 4 miles further on, having travelled under a range of limestone mountains. This river turning south, we next day ascended a tributary and came upon sago trees. As it was desirable that our food-bags should be well filled we camped and made sago. For the next two days we endeavoured to cut west; finding, however, that we were being forced almost north by the mountains, we turned south crossing two parallel ranges, the latter being 5000 feet high. Still travelling south we crossed a large valley of rough limestone boulders, and camped on a creek that gushed out of the side of a mountain; next day this stream was joined by two others which also emerged from the range, forming a considerable stream. Proceeding along this we came to a large slow-flowing river (the Mobi) coming from the north-west, 150 yards wide, with native canoes upon it. Sago being plentiful, we spent Christmas Day making sago, and next day the natives brought their canoes and ferried us across. For four days we followed this river, and then, as the ranges came steep down to the banks, we turned up a spur running west, then crossed a valley, and finding a native track we followed it up in a southerly direction, crossing a large range. This was on January 2. We camped on the south side of the range on a swift-flowing river running easterly, which the natives call the Susamiro. On January 5 we made 300 lbs. of dry sago from one tree, and the following day continued north-westerly up the stream for four days, then, finding it was bearing away to the north-east, we felled trees and crossed it on a roughly made bridge and continued west along a big limestone valley of rough boulders for four days. On January 14 and 15 we turned south, and, crossing a high range of mountains, came to a sago swamp and a big communal native dwelling (6° 29″ S. lat.), then travelled west up a valley with low limestone hills on each side of us. On the 16th we camped at a small communal dwelling. Next day we had to retrace our steps about a mile, then travelled along

the side of a range in a direction north of west; the following day we crossed the range and struck a native track which the natives said led to the Strickland river, which they called Dibiri, the native name of the Fly river. Continued on this track on the 19th, and passed communal dwelling. Next day we ascended a range, and on reaching its summit, we were delighted to see the waters of a large river about 5 miles to the south-west. We now thought that our exploration was practically finished, and that next day we would reach the Strickland, make rafts, and float down to the mouth of the Fly river. Subsequent events showed that our real difficulties had hardly commenced. We found that the mountain range we were on could not be descended on the river side as it was almost a sheer precipice. We therefore turned north. Next morning we met natives who volunteered to show us the way to the river, but they only came a short distance and disappeared. That night we camped at a creek that was strewn with lumps of hard black shiny coal; this we named Coal creek. We followed this watercourse on January 22, still seeing boulders of coal scattered about. On the 23rd we found that the river dropped over a gorge, a depth of about 300 feet, and was joined by a larger stream (the Kikor) from the north. This necessitated us climbing a mountain range, direction westerly. We camped that night on the range without water, and in consequence were unable to cook any food (rice or cornflour) for the natives, although we could hear the river thundering 1000 feet below us. On the 24th we struck south in the hope of coming to water; reaching the south-western side of the range we found the sides very precipitous, but pushed on as we could hear the roar of the water below. In places it was so steep that native lianas had to be cut to lower ourselves down. In this way we arrived at a large river after a descent of 1200 feet. We found that we had reached a small area of flat ground of an acre or two in extent, and that the river, both to the north and south, ran in a fierce rapid through converging mountains, forming a gorge 1200 feet deep.

The only conclusion we could come to was that this was the Strickland river, and, as our latitude was the same as rapid No. 3 marked on the Strickland river on the map, we concluded this must be the rapid in question, as no other large river was believed to be in this vicinity. The illusion was heightened by the direction of the river at this point, being south-east, and by an island in the rapids, both corresponding to Rapid No. 3 marked on the Strickland. It was evident that while we were able to climb down to the water's edge, it would be impossible for the carriers with their loads to climb out; nor was it possible to cross the foaming cataract or walk along its bank, which rose from the water's edge to a height of 1200 feet. It was therefore decided as the only possible course to build four rafts and shoot the rapids, which we expected to be of no great length, when we hoped to be in smooth water. These we built on the following day, and, early on the morning of the 26th, I started on the first raft with three police and two carriers, Messrs. Bell and Pratt and

party to follow and the other rafts in quick succession. Before I had gone 200 yards my raft was upset in the swirling torrent of water; fortunately we were all able to cling on and regain our positions on the upturned raft. Instead of the rapids disappearing they became worse and worse, with large waves and whirlpools; we were unable either to stop or guide the raft. After 4 or 5 miles of this wild career we were dashed into a timber block, and our shattered raft piled up 6 feet above the water-level. One of the native carriers was either injured in the collision or had been crushed against the rocks coming down, and could not stand. The poor fellow died next morning. All our food, clothing, and baggage were lost, and we had nothing left but three rifles, my revolver, ammunition, and sheath knives. We started to cut a track back along the river with a view of joining the rest of the party, but found that we were on an island with swift flowing rivers on either side of us; here we camped, and I was relieved to hear a rifle fired, which we at once answered. My wet matches were dried, and a fire lit. Next morning we tried to ford the river, and succeeded after being carried down some distance; the lighted fire-sticks we were carrying were lost, and the matches so wet that they were quite useless. Continuing to cut a track up the river, we met two police who had lost their rifles. They informed us that Bell and Pratt were on the other branch of the river with six police and the carriers, though some of the latter had been drowned. As it was impossible to cross the river at this point, and as we had been already two days without food, I determined to turn round and travel down the banks of the river as quickly as possible in the hope of finding natives or native gardens or smoother water suitable for rafts to enable us to rejoin our comrades. As we had no fire, the products of the forest, such as sago and native breadfruit, even if found, would have been of no use to us as we could not cook them. Unfortunately the country was so rough and devoid of sago or breadfruit that there were no natives or native tracks in the district. We cut our way for 5½ days, during which I had no food of any kind, and no shelter except a few palm leaves the exhausted police placed as a rude shelter, which made no pretence of keeping out the torrential rain which fell during three nights out of the five. The natives were able to eat a little palm pith, but it could hardly be called food. On the fifth day, after travelling in all 20 miles, we saw some natives on the opposite bank who held up baked sago. We determined to cross the rapids next morning at all hazards, and built a rough raft, getting across quite exhausted. While we were eating the food kindly given us by these wild savages, who had never seen a white man before, a shout was raised as Bell, Pratt, and party emerged from the jungle. I found that they had had an even worse experience than I had with their rafts. Mr. Pratt, though a powerful swimmer, narrowly escaped being drowned in a whirlpool that sucked him under the surface, while Mr. Bell had an equally narrow escape. Unfortunately I found seven carriers had lost their lives, making a total of eleven deaths during the exploration, of which nine

were the direct or indirect result of the raft disaster; these carriers were Orokolo and Vailala natives, and of very poor physique; five were unable to get to land out of the swirling torrent, and two more died shortly after with the knocking about they had received on the rafts. The party were able to keep a fire going and subsisted on a few breadfruit, and the day before they met me they shot a wild pig. None of the police lost their lives. These men are chosen for their strong physique from the villages, and the men I had were the pick of the police and had become hard and muscular by regular exercise and ample rations of rice, meat, and biscuits; whereas the carriers, although receiving the same rations on the expedition, were thin and travel-worn. Captain Rawlin, who has done such excellent explorations in Asia and New Guinea, experienced the same difficulty. He stated in his lecture, the list of casualties from death and sickness was appalling. During the first year 12 per cent. of the total force died, while 83 per cent. were invalided out of the country. Of three hundred men employed during the first twelve months only eleven lasted out the expedition, and of these four were Europeans.

It was now evident that this river could not be the Strickland, as it was turning to the east, and we concluded it must be the Bamu, although, at a later date, doubts were raised in our minds by its persistent course in a south-easterly direction. Thankful for our providential escape, we were taken by our bushmen friends to their village about 3 miles off, where they gave us some more sago; they also pointed out where sago trees could be found, and we were able to make a good supply of food. The natives had evidently heard about us, and the great care we had exercised in seeing that those we had previously met had been justly treated and not robbed by our carriers now stood us in good stead, and instead of killing my small and exhausted party they gave us all the food they had, although we had nothing to give in return. We were now hopeful that the river would soon be clear of rapids, and that we could make rafts and get to the coast, as otherwise the responsibility of bringing down a somewhat exhausted party, without food or baggage, through rough and unknown country for 300 miles to the coast, was very great. Contrary to our hopes, the rapids and gorges continued for another 100 miles, and the twenty-nine days we spent in getting over that distance was a time of scarcity and privation, during which we rarely had a full meal. On one occasion we were seven days without getting anything to eat except a few handfuls of soup-powder, and some tins of cocoa that had been saved from the capsized rafts. After this long tramp we came to a large communal house, where we saw the first coconut trees since leaving the coast. The natives treated us most hospitably, giving us all the sago and coconuts they had, and intimated by signs that they would go out next morning and make more sago for us. As we were leaving they came in great excitement and intimated that one of us had stolen from them a necklace of dogs' teeth. The carriers were searched and interrogated, but it could

not be discovered. We satisfied them by a gift of the only good scrub-knife we had, and which we required for cutting our way through the jungle. On our way down we found the necklace in the possession of a carrier; he was tried before a magistrate at Daru, and in view of the wantonness of the offence, and the fact that he had endangered the lives of the whole party, he was sentenced to six months' imprisonment. During the whole thirty-one days, as we had no matches, we kept a fire burning day and night. At night we slept in dry caves, rock shelters, or under hastily constructed palm-roofs, which were never rain-proof. On the twenty-ninth day we believed the river was smooth enough for rafts, and we again embarked, with better results, as the first day we advanced about 50 miles without any serious mishap. The next day the rapids again appeared. Our two frail canoes (little more than hollow logs open at both ends except for barriers of mud) were upset and we were dashed down the river over a succession of rapids, hanging to the upturned logs, for about 10 miles before we could get to land. That night we spent in the pouring rain without food, and at daybreak on March 3 we started again, passing successfully over several rapids, and, to our great relief, about nine o'clock that morning, saw European tents and whaleboats, and were given a most hearty welcome by Mr. L. Brown, officer of armed constabulary, who had been sent out to search for us. It was only then we ascertained it was the Kikor river that we had been coming down, and that Mr. Brown was encamped on the exact spot from which we had struck north at the beginning of our overland journey. Two days later we reached Goari Bari island, that we had left fifteen weeks previously, after travelling approximately 524 miles over totally unexplored country (374 miles on foot, and 150 by river).

The only instruments carried on the overland march were two aneroids, a nautical sextant and artificial horizon, two prismatic and three pocket compasses. Owing to the character of the country, Mr. Pratt had to rely largely on a traverse (using a magnetic compass to obtain the bearings), and estimates of distance based on the rate of speed. This work was checked by observations for latitude. It was only possible to obtain one longitude by observation, at the point on the Kikor river at which we had struck inland, as a chronometer could not be taken overland. The course of our return journey is only approximate, as all our instruments were lost, except one pocket compass and an aneroid, in the raft disaster.

I feel that I was extremely fortunate in the men I selected to accompany me. Both Mr. Bell and Mr. Pratt are good bushmen, possessing hardy constitutions and indomitable pluck and endurance, which enabled us to continue our march against the most serious obstacles. If we have accomplished any useful work by this expedition, I should like the credit to be equally shared by them. The conduct of the armed native constabulary was most praiseworthy; in spite of illness, fatigue, and hunger, they carried out their difficult duties with the same regularity,

despatch, and absence of complaint as if on parade, keeping guard at night, assisting the weaker carriers, preparing bush shelters, and patrolling the country in search of tracks and food, while the few edible berries and seeds found by them they offered to share with us.

I should also like to express my great obligations to His Honour Judge Herbert, who most ably and expeditiously organized search parties, one of which he led far inland in search of us; also to Messrs. Wilfred Beaver and Ryan, who followed in our tracks a distance of approximately 150 miles.

Notes on the Expedition.

Topographical Features of the Western Division.

The Western Division of the territory comprises more than half the total area of the territory, or 54,000 square miles out of a total of 90,540. Every other Division has already been explored, and the main features of the country fairly accurately recorded on our maps.

The great Western Division, having a frontage of 280 miles to Dutch New Guinea, and 300 miles to our German neighbours, has remained a *terra incognita*, with the exception of a broad fringe of coastal country and the land along the banks of its navigable rivers. Many attempts have been made during the last twenty years to learn the secrets of the interior, but they all resulted in failure until, about three years ago, Mr. Donald Mackay and party were successful in penetrating west from the head of the navigable waters of the Purari for a distance of 60 or 70 miles. This expedition took six months to accomplish, and cost its public-spirited leader over £1000. The information thus obtained forms a most valuable contribution to our knowledge of the interior.

The exploration just completed has been successful in travelling practically across the centre of the unknown area, and returning by another route, also through unexplored country.

As the land-surfaces along the coasts of this Division, and on the banks of the great navigable rivers, consist of low-lying recent alluvial deposits, it has generally been considered that nearly the whole of the Western Division was a low-lying swampy region. The Mackay expedition showed that this was not the case so far as the eastern portion was concerned. The present exploration has proved that this Division has a larger area of elevated land than any other division in the territory. From our ascent of Mount Murray, which attains an elevation of 8000 feet, we travelled generally in a north-westerly direction for 200 miles, and, during the whole of this distance, the lowest valley crossed was over 2000 feet above sea-level, one considerable valley, immediately to the north-west of Mount Murray, having an elevation of 6000 feet.

In returning we skirted the western and southern boundary of this great plateau, stretching north from the seventh parallel of south latitude to the main range on the German boundary, and lying between the Purari

and Strickland rivers. We are able, therefore, to fairly accurately estimate its area as 12,000 square miles.

River Systems.

While the eastern portion of this plateau is drained by the Purari river, at least three-fourths of this vast elevated area is drained by the Kikor and its tributaries; the latter river (skirting its western and southern boundaries), has its source in the main range near the headwaters of the Strickland, and flows at first south for a short distance, and then generally south-east for 300 miles to Goari Bari island. It also possesses tributaries to the east, draining the country right up to the Purari watershed. The area of recent alluvial and hilly country to the west and south of the plateau is drained by the Fly (with its great affluent—the Strickland), the Bamu, and Turama rivers, and a few small streams.

Geological Features.

The whole of the plateau that I have described consists of huge upraised limestone beds, except in a few instances where intrusive igneous rocks (basalts) have been forced through the limestone strata; this extends right up to the main ridge, which we saw at an estimated distance of about 30 or 40 miles. There is little doubt that the main range is largely composed of volcanic rocks, as the beds of the rivers draining its southern slopes are filled with rounded water-worn basalts. The whole of the plateau consists of alternate ranges and valleys, the general trend being north-west and south-east. The country is indescribably rough, the mountain ranges consisting of huge masses of jagged and precipitous limestone rock, making their ascent always difficult, sometimes impossible, while the valleys, except in a few instances, are covered with masses of coral wedged together, and sometimes 40 or 50 feet in height. Our average rate of progress (including stoppages to make sago) over this plateau was a little over 3 miles a day, and the lightly loaded carriers generally came into camp exhausted with their day's journey. Another peculiarity of the valleys was that, over hundreds of square miles, huge round holes, perhaps 100 yards across and 50 to 100 feet deep, sloping down to a point, occurred at regular intervals and in a given direction. When we turned from our course to avoid these, we came upon another set of parallel holes. These valleys resembled a backgammon board, the space between the holes being filled up with ridges of coral rock. Probably these marked the courses of underground rivers; indeed, in one instance we followed these along until we came to a river gushing out of the side of a range. Occasionally we would come to fertile valleys of good alluvial ground on the banks of rivers and streams with sago swamps, and in such places the native population was more numerous.

Although the rainfall was heavy and of almost daily occurrence, especially in the eastern portion of the plateau, we had on many occasions

to go without water for periods of from twenty-six to thirty hours as the rain sank through the limestone, leaving no surface water except in the lowest parts of the valleys. The whole country is like a huge dripstone filter. This made the details of the river system most baffling. Continually we followed down a considerable stream only to find it suddenly disappeared into the base of a mountain, reappearing miles away on the other side of the range, thus constituting a huge underground drainage system. Over this area there are consequently no lakes, and doubtless the whole region is honeycombed with large caves.

A noticeable and interesting change in the country occurred when we were approaching the headwaters of Kikor river. In the beds of the creeks were found sandstone, mudstone, limestone and conglomerate, but no volcanic rocks. The limestone contained many fossils, and a block of sandstone was secured which was literally packed with clearly defined fossil sea-shells of various kinds. Unfortunately, all these specimens, as well as others previously obtained, and all our records were lost in the raft disaster, and the effort to definitely ascertain the geological age of the region was frustrated. Associated with these sedimentary rocks were blocks of bright hard coal belonging to the Palæozoic period (Carboniferous or Permo-Carboniferous), the fossilized beds of limestone probably overlay or are interbedded with the seams of coal. Possibly the country here, although now near the centre of New Guinea, once constituted a sea-shore—the land frontier of the great central mountain chain that forms the backbone of the island, prior to the elevation of the extensive coral beds that now form the plateau we traversed, which probably belongs to the Mesozoic age.

The Natives.

The description of the country given postulates a somewhat sparse population over this elevated portion of the Western Division. At Sambregi, immediately to the north-west of Mount Murray, are a cluster of villages with an aggregate population of about 1000 people. Throughout our trip we saw only one other village of any size, which we reached on December 27. This was on a large tributary of the Kikor flowing south of east. In every other instance the tribe or clan lived in one communal dwelling, varying in dimensions according to the size of the community, and capable of housing from ten to seventy people. These dwellings, especially the smaller ones, are generally hidden away, or perched on steep ridges, that are not easy of access, probably from motives of defence. The population of this area of elevated land is estimated at 15,000 inhabitants, or about one and a quarter persons to every square mile.

The native inhabitants of the interior do not appear to be a homogeneous people; racial distinctions are apparent that seem to indicate a mingling of Papuans and Papuo-Melanesians, to use the terminology of

Dr. Seligmann. Some of the inhabitants of a village were dark-skinned, dolichocephalic men, with wiry frames and somewhat slender limbs, and, in disposition, rather morose and unemotional. In not a few instances the somewhat prominent nose was arched, presenting the appearance of the so-called Semitic type. Other villagers, again, were unusually light skinned—more the colour of a Samoan. The high altitude might accentuate this. I was unable to obtain the cephalic indices of any of the natives, as they were very shy, and we could not afford to make a long stay anywhere. The faces of the light-skinned men were broader and shorter than their darker neighbours, their limbs stouter, and they appeared to be more vivacious and intelligent, and also to be fonder of ostentation in the shape of ornaments and paint. The Melanesian migration into New Guinea is believed to have advanced along the north-east coast as far as Cape Nelson, where their progress was stopped by the warlike Binandili tribes; and along the southern coast till they reached the populous villages of the Gulf country. It is, however, not yet known how far the immigrant race penetrated inland. Certain of the inhabitants of the main range near the Gap, at Mount Albert Edward, and on the Chirima, as well as in the neighbourhood of Mount Yule, are lighter skinned and broader headed than the Papuan, and it is possible that the Melanesians have gradually diffused themselves inland along the southern slopes of the main range, where the original inhabitants were few in number, and therefore less able to successfully resist the advance. The greatest obstacle would be the natural features of the country, which would necessitate very slow progress. This might account for the marked distinction in physical characteristics which have not yet been obliterated by miscegenation. The light-skinned people were nearly always in a minority. Mr. J. P. Thompson, in his book, 'British New Guinea,' speaks of the "remarkably light bronze colour" of some of the natives of the upper Fly river.

I obtained a small vocabulary—principally substantive nouns—from the Sambregi tribes, immediately to the north-west of Mount Murray, in the hope that it would contain sufficient information to enable philologists to determine if the language was Papuan or Melanesian; unfortunately, this was lost with all other papers in the Kikor river.

By exercising great forbearance and patience, we were fortunately successful in making friends with these bushmen everywhere. As they had never seen white men before, our arrival caused great excitement. At the first small communal dwellings we reached they all turned out with their bows and arrows, and stood shouting their war cries. They naturally thought we were a marauding party, and naturally and rightly they were prepared to defend their wives and children and homes. While they were in this condition of extreme excitement our party sat down, and, although our arms were ready for any emergency, appeared to take no notice of them, except to hold up some red cloth. They then retired, and, when some presents were sent up to the house, we found that they had all

fied, the hostile demonstration being probably to allow the women and children time to get away into the jungle. Great care was taken that nothing was touched, and a tomahawk, a knife, and some red cloth were left in the house. Not seeing them return, we started on our march next morning, and in the afternoon were overtaken by the natives, who, when they found that we had no desire to hurt them, evinced the greatest joy, and made us presents of food. After that for some days we experienced little trouble in establishing friendly relations with the natives we met. Possibly, by some bush telegraphy they had notified the other tribes that we had no desire of injuring them. In many instances the friendship of the natives was of great service to us. Not only were we able to buy food, but they showed us native tracks, and, in one instance, took the whole party over a wide river in their canoes.

The inhabitants of the Sambregi villages were particularly interesting as they live at an elevation of 6000 feet above the sea-level, the highest elevation, I believe, of any Papuans so far visited. The physique of some of the young men was magnificent, the Kagi men of the main range approaching most closely to them in this respect. While the tracks between the villages at Sambregi were in wretched repair, and the houses below the standard of native dwellings in Papua, these people excelled in drainage schemes. The gardens in the rich low-lying portions of the valley are drained into the Sambregi creek by water channels varying in depth with the contour of the land. In some cases the drains are as much as 8 feet in depth; no water lodges in them, and they are kept in excellent repair. With the exception of the native irrigation channels near Dogura in the Eastern Division, in no other part of the territory do the natives show such knowledge of channel construction. Although it is most improbable that any of these bushmen have ever seen the sea, it is evident that they are able to carry on some trade with the coastal men, probably through many intermediate tribes, as we found them wearing sea-shell ornaments, and possessed, in some instances, of iron implements, such as a much-used axe blade and plane irons. They also knew the names of the Kikor, Turama, and Bamu rivers, but their ideas as to the directions of same were sometimes far from correct.

While these far-inland bushmen are probably cannibals, we were unable to find any direct evidence. At Sambregi one youth had a skull hung round his neck, and one man a pair of human jawbones; these, however, may have been the remains of relatives. In their dubus, or communal dwellings, we saw no skulls or other human bones, although the jaws of pigs and other trophies of the chase were in evidence.

It appears that the natives bury their dead, and, at any rate in some instances, dig up the bones at a later period and put them on platforms. In one instance we saw a tiny house like a small dove-cot built on piles about 6 feet from the ground. In this was a skull painted with red ochre, and some bones. We also saw a platform recently erected, and the natives

indicated that it was for human bones. In a rock shelter we saw two skulls and bones placed side by side in a circle of stones; close by were evidences of a grave having been opened and bodies exhumed.

For clothing the natives wear a piece of netted cloth hung down from the waist in front from a wide girdle of bark; at the back dried grass or the bright coloured leaves of a plant. In other instances, tapa cloth was hung from the waistband. As a head-dress they wore the black plumes of the cassowary, or the feathers of the white cockatoo; very occasionally we saw the plumes of the raggiana bird of Paradise. Their hair was usually worn short in front and long behind, clotted into tags and rolls, either with oil or honey and wax of the little black stingless bees. The hair is not bleached with the lime as in other parts of the territory. They wore cane armlets, anklets, and waistbands. These canes were used for fire making. The septem of the nose is pierced and the lobes of the ear, and various things hung thereon from a pencil of bone to circular pieces of cane and the claws of birds. It is remarkable that during our whole trip we saw no evidence of tattooing nor any cicatrices or mutilation of the body. Skin disease was exceedingly rare, and only seen in one or two instances in the adults, and rather more frequently amongst the children. In fact, the natives generally were a remarkably healthy lot of people. In time of war, and probably on festive occasions, they paint themselves either wholly or in part with yellow or red clay, or with ground charcoal and oil. The women wear a tapa cloth rami from waist to knee. They also have tapa cloth cloaks which cover the head and reach to the ground; this I have seen nowhere else in the territory. In their dubus or communal dwellings they keep rolls of tapa cloth blankets as the nights are cold on the great plateau.

They have no pots or cooking vessels; they wrap their food in leaves and cook it over the fire. May I claim for the Papuan that this is the genesis of paper-bag cookery, and that these dusky savages have led the way in a great culinary reform? The only exception I saw was in the case of the leaves of an oleaginous plant which they boiled as a vegetable in bamboos. We saw no evidence of polygamy, and the probability is that it is not largely practised. From the inhabitants we saw, the women folk seemed less numerous than the men, but this may have been owing to the warriors keeping them in the background. Children seemed fairly plentiful. The time of the men is principally occupied in clearing ground for gardens, hunting the pig, cassowary, and flying-fox, building houses, making weapons, and cutting down sago trees. The women make all the sago—a continuous and exacting occupation—look after the gardens, do the cooking, and carry the water required for household purposes in bamboos. They also hammer out the tapa cloth from the bark of a tree, and look after the rising generation.

These bushmen are certainly not a nomadic people. Their buildings are substantial, and, in every instance, they had a considerable garden and

a number of village pigs. Their weapons consist of the bow and arrow, a heavy pig spear which is not used for throwing, and a man-killing club. Very rarely we saw stone clubs; these had probably been introduced from the coastal districts. The bow and arrow men wore plaited gauntlets from wrist to elbow on the right arm. The stone axe and adze are largely used. The natives do little carving except on their arrows (which are made of bamboo, often tipped with bone or a cassowary's claw), spears, and wooden clubs. They also carve out wooden bowls to hold water; these have no ornamentation. The tribes on the western portion of the plateau seemed to be at war with each other during our visit; they were frequently met in full war paint, with bundles of arrows and killing clubs; in one instance they informed us by signs that they were on their way to fight a neighbouring tribe. Possibly, constant internecine strife keeps their numbers down, and accounts for the comparatively sparse population, as the climate is bracing and healthy and the natives singularly free from disease and full of vigour.

Their method of making fire is superior to the usual Papuan system. They get a piece of dry soft wood, split one end and insert a piece of tapa cloth, then taking a piece of cane, which they carry twisted round their waists, they place it under the wood on which they stand. Grasping each an end of the cane, they pull it backwards and forwards vigorously; when it has eaten halfway through the wood to the tapa cloth the heat generated is so great that the cloth smoulders and is blown into flame. The whole process is accomplished in ten or fifteen seconds. I am informed that certain natives on the main range about Kagi adopt this system also; if so, it is interesting as possibly showing some connection between them.

With the exception of two large villages, all the natives we saw were split up into small tribes, and each community has one communal dwelling, varying in size, according to their numbers, which would probably range from ten or fifteen up to seventy or eighty. The dwelling is erected on a forest of piles composed of thin but durable wood, and is elevated from 10 to 12 feet above the ground. The sides of the great living room are only about 4 feet high, and the pitch of the roof is low. The roof is made of the fronds of the sago palm, each separate leaf being doubled round the rafters (which are only about 6 inches apart), and sown with native fibre to keep it in its place. At one side of the entrance is a partition, which does not reach as high as the roof; this divides the house lengthways into the men's quarters on the one side, and the women's and children's on the other. In each subdivision there is a gangway the whole length, and on one side of each a raised floor which is subdivided alternately into sleeping platforms and fireplaces, each about a yard in width; above the fireplace is a platform filled with wood, and above each sleeping place another platform on which the men keep their weapons and other effects, and the women their tapa cloth, bamboo drinking-vessels, and food supply. The dogs share the building with the natives. The

house is generally surrounded by a garden. Variations of the above were seen. Near Mount Murray there were two additional rows of sleeping platforms and fireplaces on the ground level, one on each side with a separate entrance for each. Again, about 300 miles up the Kikor at the largest dubu we had seen (which we estimated was 70 yards in length), the partition, instead of running lengthways was across the centre of the building dividing the men's and women's quarters. We had travelled down the Kikor about 116 miles to this point before we came upon the first cocoanut trees we had seen on our journey, nor did we see any more until we reached the mouth of the Kikor. We found that the language or dialect of the people was continually changing as we advanced. At the Sambregi a vocabulary of the most useful words, principally substantive nouns, was compiled; this, besides being of philological interest, we hoped would be of use to us in communicating with the natives we subsequently met; we found, however, that after advancing about 20 miles, the dialect changed, and very few of the words could be understood. Further on the language was quite different.

While the many tribes of natives we met on our exploration showed no suspicion and absolute confidence in us, after we had succeeded in establishing friendly relations, frequently coming to our camp and sitting round the fire at night, and bringing their women and children to see the "pale faces" during the daytime. They all, without exception, refused even to taste any food we offered them, although they would take it and wrap it up in leaves, probably as a curiosity. This refusal may indicate that they possessed a knowledge of poison (we saw a fish-poison tree in one of their gardens), it may, on the other hand, have risen from a fear of "pouri-pouri" or witchcraft, or again, it may be that they were conservative in their commissariat, and did not care to eat new foods they were not accustomed to.

Climate.

The climate of the plateau was cool and bracing, the nights being sharp and cold. This doubtless accounts for the healthy appearance of the people who also gave evidence of greater activity than the coastal races. The rainfall on the eastern portion of the plateau was heavy and of almost daily occurrence, generally commencing about four o'clock in the afternoon. As we advanced west the rainfall became less frequent and torrential, only falling on an average about three or four times a week. This might be accounted for by the great distance we were from the sea.

Coal.

There is every probability of large beds of good coal being found on the borders of the great plateau, although I do not think that any minerals of value will be found in the elevated region caused by the upheaval of the coral beds. Coal has been found on the upper waters of the Purari by the Mackay expedition, and it was found by us both on the lower and

upper waters of the Kikor river. On the upper waters of the Kikor there is undoubtedly a very extensive field of excellent coal. Unfortunately, the large number of specimens we were bringing down were lost when the rafts capsized. We followed down a creek for some days that brought us to the Kikor. Everywhere the bed was strewed with lumps of good-looking, bright, hard coal, and for about 15 miles down the Kikor coal was seen in almost every little creek and waterway, as well as on the banks of the river. To attempt to develop this field by the Kikor waterway is evidently impossible, as for 120 miles the river is one succession of rapids, whirlpools, and gorges. There is no reason why this coalfield should not extend further west, in fact a seam of coal was seen on the western side of the river, and, if so, it might be worked from the Strickland river, which it was estimated could not be more than 20 miles distant.

The coal we found on the lower Kikor was one isolated lump considerably weathered. However, as the creek was a very small one, running northward for only a few miles, it is evident that the seam from which it came could not be far off, and, when a magisterial station is established on that river, a fuller investigation might be made. If a large bed of good coal could be found here, I believe barges might be brought up the river to within 6 or 7 miles of it, although two very small rapids occur on the route. These run swiftly when the river is high, but are barely noticeable when the river is not in flood.

Flora.

The whole of the country traversed was covered by dense jungle and scrub, and we literally had to cut our way through the 374 miles traversed on foot, except where we occasionally met a native track going in the desired direction. It was surprising that over rough coral ranges and valleys trees of considerable size and dense scrub could find a roothold and sufficient nourishment. The roots spread all over the surface of the rocks, constituting steps and ladders up the steep mountain-sides, without which their ascent would have been most difficult. A remarkable fact was that we saw no grass whatever, except a little reedy grass near the rivers during our whole trip.

Of the economic flora, by far the most important was sago (*Sagus Rumphii*). We found these useful storehouses of nourishing food growing as far north as we penetrated, and up to an elevation of 3500 feet. It had previously been considered that sago only grew along the coast and in the alluvial mud of river-banks near the sea-level. This constitutes the staple food of all the inland natives we met, except the inhabitants of the Sambregi villages, who live principally upon sweet potatoes, the elevation (6000 feet) being too great for sago. Wild breadfruit trees are fairly numerous. The fruit, unlike the Samoan breadfruit, is full of large seeds nearly the size of walnuts. These, when roasted, are palatable and make a good substitute for potatoes. The natives when hungry eat the pith of a small palm that grows plentifully over a large area of the

country traversed by us. In time of scarcity our police and carriers consumed a good deal of this. To our palates it had a watery and woody taste that was far from agreeable; in fact, when hungry I tried to eat it, but in each instance it made me sick. I collected the seeds of several indigenous fruits, which, while not very palatable, might have been improved by cultivation, but these were lost with the other things.

Cultivated in the native gardens we found sweet potatoes, taro, yams, sugar-cane, bananas, betel-nut, and ginger, the last-named cultivated as a medicine. Maize is unknown. No coconut trees were seen on the whole trip until we reached the lower waters of the Kikor river, nor are there any mango trees or tapioca. The natives grow a green vegetable, the leaves of which they boil in bamboos. It makes a very good substitute for cabbage and appears to contain a lot of vegetable oil.

Tobacco is cultivated in every native garden, which might lead one to suppose it was indigenous; the name, however, tends to show that it is an introduced plant. It is universally called "Suku" by the bushmen, which is evidently derived from "Kuku," the coastal name. In one of the gardens on the headwaters of the Kikor I found a Kava plant (*Macropiper methysticum*) although I saw no evidence of the manufacture of the beverage.

Fauna.

The wild pig, judging by the amount of ground that is rooted up, is plentiful everywhere. It is the chief source of meat-supply for the natives, and is continually being hunted with dogs, the killing weapons being bow and arrow and spear. The only animals domesticated are the pig and the dog. The wallaby is very scarce, owing to the absence of grass. Cassowaries are fairly plentiful, their black plumes forming a favourite head-dress. Flying foxes are very numerous. Their flesh is much relished by the bushmen. Tree-rats were occasionally seen, and the streams abound in fish of excellent quality. Two or three were shot with a rifle, but as we had neither fishing-lines nor nets this luxury was usually denied us. The natives catch the fish by spearing them and by fish-traps composed of stones or pickets across the streams. The little black stingless bee is common everywhere, and the honey and comb is much prized for food and as a dressing for the hair.

Cockatoes, both black and white, and pigeons were plentiful. Those wonders of avian architecture, the playgrounds of the bower bird (*Amblyornis subalaris*), were seen on Mount Murray, at an elevation of 7000 feet. Of insect pests, the land leeches were very troublesome. The feet of the police and carriers were often red with blood from their bites. We tried painting their feet with sulphur ointment, but it proved quite useless. Scrub itch was very bad, except in the valley of the upper Kikor. The scrub itch is caused by a minute red insect that buries itself under the skin. Mosquitoes did not trouble us while on the highlands, but both they and sand-flies were very troublesome on the Kikor river.

The "leaf" or "stick" insects were fairly plentiful, and in some instances their resemblance to the plant life in their immediate environment was wonderfully accurate. One insect resembled a stick covered with green moss; the green colouring appeared so exactly like moss, that a member of our party refused to believe it was not actually moss until he had examined it with a magnifying glass.

On the map accompanying this report the course of that portion of the Kikor river lying to the west of the 144th meridian of east longitude is only approximate, as, while descending this river, most of our instruments were lost, and the compass-bearings and estimated speed could not be checked by observations for latitude. In addition to which the great difficulties that beset us on our return journey did not permit of the careful mapping previously undertaken.

The most important results of the exploration were—

(1) We went practically right across the centre of the unexplored portion of the territory of Papua, travelling approximately 524 miles through totally unexplored country (374 miles on foot and 150 by river).

(2) We ascertained that instead of the Western Division of Papua being low-lying recent alluvial country, as previously supposed, it is (except along the coast and in the vicinity of its navigable rivers) an upraised plateau having an area of approximately 12,000 square miles, the lowest valley being over 2000 feet above sea-level.

(3) The upper waters and watersheds of the great rivers emptying into the Papuan gulf are now roughly defined, thus completing our knowledge of the river systems of the territory.

(4) We have now data for estimating the population of the whole territory with some accuracy, the hinterland of the Western Division being formerly an unknown quantity.

(5) We found coal deposits in two places along the watershed of the Kikor river, the coal country along its upper waters being very extensive.

(6) We found sago growing inland as far as we penetrated and at an elevation up to 3500 feet.

(7) We established friendly relations with the natives everywhere, and were successful in avoiding all fighting.

Major DARWIN, Vice-president (before the lecture): I am very sorry that our President, Lord Curzon, although he was able to attend our Council meeting this afternoon, is still suffering from such a bad cold that he is advised not to go out to-night.

Our lecturer to-night deals with the unknown parts of New Guinea. That territory was handed over by the Home Government to the Commonwealth of Australia some seven years ago, and is now administered by the Dominion Government. The administration is in the hands of a Lieut.-Governor and an Administrator, and in making the appointment of Administrator the Dominion Government naturally selected one of their own citizens—one who was born in Australia, educated in Australia, and who had served in the Senate

of the Australian Commonwealth—Mr. Staniforth Smith, our lecturer of to-night. I will not anticipate his remarks about his plucky journey. He was away rather longer than he expected, and in his absence certain sinister rumours were circulated in Australia, which I am very glad to say turned out to be entirely untrue, for had they been true he would not have been here to-night.

Sir Newton Moore (after the lecture): Although I have no personal knowledge of Papua, I have a very intimate knowledge of the lecturer, as, although a native of Victoria, he spent a good deal of his time in Western Australia, and was mayor of the great city of Kalgoorlie for a considerable time, and afterwards was one of the first senators to enter the Commonwealth Parliament as a representative of Western Australia. He proved to be an excellent legislator, and I think you will understand from to-night that he is a practical administrator, that he is prepared to endeavour to acquire a knowledge of the territory he is in charge of, and is prepared to risk his life in order to gain that knowledge. I sympathize with him in his work, as that little instrument that you saw with the surveyor is one I have carried for many thousands of miles in Western Australia, and have had an opportunity of judging from personal experience some of the hardships they would have to undergo in the western districts and undeveloped portions of the territory, and it speaks highly for Mr. Staniforth Smith that he and his party were able to carry out this great work in the systematic manner they have done. They have located many important points, and been able to fill in many blank spaces in the map of New Guinea, and I can only say it has been a great treat to me to-night to have had an opportunity of listening to his lecture, and am proud, as a fellow-Australian, of the work he and his party have dene.

Captain C. G. Rawling: I will not detain you many minutes; but must congratulate Mr. Staniforth Smith upon having delivered one of the most interesting lectures I have heard at the Society. My remarks will take the form of a comparison between the obstacles to travel in Papua and in the Mimika district, in which we have of late been working: 600 miles divide the two territories. In the Mimika district it is quite impossible to maintain a rate of progress of 3 miles a day, not only because of the density of the forest, but of the fact that the hills are uninhabited. This means that, instead of relying upon fresh supplies being obtained for the carriers from the natives, every ounce of food has to be carried, necessitating depôts and a line of communication being kept open. The fact of there being no inhabitants in the mountains alone is sufficient to prove that the vegetation is far denser in the west than in Papua. Mr. Staniforth Smith tells us that he found sago growing at a height of 3500 feet; in the Mimika district not one sago tree was found 100 feet above sea-level. With respect to the minerals, it is interesting to note that the coal discovered was hard and good, while that come across by Dr. Lorentz and by our expedition proved soft and useless. A point of interest to anthropologists is brought forward by the fact that the new tribes Mr. Staniforth Smith was amongst make fire in identically the same way as that used by the Tapiro pygmies. Now, these tribes are separated by 600 miles of almost impassable country, with a great snow-clad range between, a belt of uninhabited land, and many hostile tribes (none of whom make fire in this way). Why the same plan is used, how they learnt it, whether they do communicate with one another by some means, I am unable to say; no doubt some anthropologists will be able to solve the question. I must again congratulate Mr. Smith on having brought himself and so many men through one of the most difficult and venturesome

journeys of discovery. His chief fault was apparently that of travelling too fast, that of our late expedition of moving too slowly.

Mr. A. F. R. Wollaston: I have listened with great interest to this most remarkable lecture by Mr. Staniforth Smith. I will, if I may, draw your attention to the extreme modesty of some of the lecturer's descriptions, which can hardly be appreciated by people who have not been in the country. In those brief remarks of his, when he says "we crossed a mountain range," "went up a valley and crossed another mountain range," you may read between the lines pages—I might almost say volumes—of trials and tribulations that he had to go through. In suggesting that the inhabitants of the Sambregi villages at 6000 feet were living at the highest altitude of any Papuans so far visited, Mr. Staniforth Smith has, I think, forgotten the Papuans whom Dr. Lorentz found living up to a height of 10,000 feet on the slopes of Mount Wilhelmina. The note about tobacco is particularly interesting. The name *Suku* shows a marked difference of language from that of the Papuans of south Dutch New Guinea, who are unable to pronounce the letter *s*. Then, again, Mr. Smith suggests that the name is probably derived from the coastal name *Kuku*, and that on that account the tobacco is probably an introduced plant. But may it not be conversely, that the coastal is derived from the inland name? There are many considerations pointing to the possibility of tobacco being an indigenous plant in New Guinea; in a great number of places the best tobacco is grown on the mountains in the interior, whence it is traded to the people near the coasts; and on the upper waters of the Fly and Kaiserin Augusta rivers tobacco was known to be in use long before it was known to the natives along the lower parts of those rivers. The use of the split stick and rattan for making fire by the people of this region is interesting, as affording another link in the chain of places where this method is employed; the other places are the Owen Stanley range in British New Guinea, the hills at the head of the Noord river and the Mimika river (Tapiro pygmy people) in Dutch New Guinea, Sarawak, and at some places in the Malay peninsula. It may not be out of place here to suggest that it is not yet too late to alter the name Papua, which has been applied by the Australian Government to the territory formerly known as British New Guinea. The word Papua (pronounced Papoóa) signifies "woolly," and is in use among the Malays of the archipelago, who apply it to the woolly-headed natives of New Guinea, and in course of time the island itself came to be called Papua. The true Papuans, as recognized by anthropologists, are more characteristic of Dutch than of British New Guinea, where they are in a small minority, so that, apart from the absurdity of its meaning, it seems a pity to name the territory Papua.

Mr. Arthur Jewell: I have had the pleasure of being very closely associated with New Guinea for the past nine years, and as far back as 1904 I spent eleven weeks as one of a Government expedition in the deltas of the rivers about which Mr. Smith has been speaking to-night. Mr. Smith has enumerated many of the advantages and good results accruing from an expedition of this kind, but there is one, if I may be permitted to say so, which he has apparently overlooked, and that is in connection with the industrial development of the country. It is after such work as Mr. Smith's that industrial development follows, for we are put in possession of knowledge relating to the agricultural, mining, and labour resources of a hitherto unknown country. The peaceful pacification of the natives is perhaps the most important feature of such expeditions, and I am sure you will agree that all who are interested in any way in this great and wonderful country, whether scientifically, industrially, or

otherwise, must feel themselves under a debt of gratitude to Mr. Smith for work he has done.

Major DARWIN: I know nothing about New Guinea myself, but, as you know, I have been to many lectures in this building. There are three qualities every explorer must have: he must have personal courage, he must have forethought, and he must have the aptitude of making friends with the natives. I think our lecturer has been conspicuous in all these three qualities. Only one other thing is necessary, and that is a bit of good luck. Whether to say he had good luck or bad luck, I do not know; he had extremely bad luck in certain respects, but he had the good luck that he was not drowned, and on that I think we all congratulate him. He evidently ran very great risks. I am sure I may, in the name of everybody present, congratulate him on his success, and thank him for his most interesting lecture.

JOURNEY THROUGH A PORTION OF SOUTH-EASTERN TIBET AND THE MISHMI HILLS.*

By Captain F. M. BAILEY.

THE following account of a journey through a small unsurveyed portion of south-eastern Tibet and the Mishmi hills may be of interest in view of the military and political measures recently taken in consequence of the murder of Mr. Williamson and Dr. Gregorson by the Abors.

I travelled out by the Siberian railway, and after being detained for a week in quarantine, on account of the plague which was raging in Manchuria, reached Peking on March 8, 1911. Having spent a week in the capital and obtained a passport, I took the train to Hankau, where it was necessary to wait for some days before an up-river steamer left for Ichang. From Ichang I passed up through the Yangtse gorges, about which so much has been written, in company with Mr. Hill of the Chinese Customs, who shared a house-boat with me for this part of the journey; unfortunately, we were wrecked in one of the rapids, and obliged to pass the night in the open. On reaching Wan-Hsien, I spent two days with Mr. and Mrs. Ortolani, of the Imperial Post Office, while making preparations for my 400-mile journey to Chengtu. At Chengtu I enjoyed the hospitality of Mr. Wilkinson, H.B.M.'s Consul-General, for a few days before continuing my journey. At Ya-chou Fu I called on one of the large firms engaged in the Tibetan tea trade, and saw coarse tea-bricks being made. At Ta-chien-lu, where the first Tibetans were met with, I sent back a useless Chinese servant who had accompanied me from Peking, and took in his place a Tibetan, who remained with me until I was about to enter the Mishmi country.

From Ta-chien-lu I made an excursion in search of Takin (*Budorcas taxicolor*) to a place some 15 miles to the south, crossing a pass called Boi La (13,240 feet), which on May 14 was covered with snow about a foot deep. From here some very distant snow mountains were visible to the

* Map, p. 420.

south and to the south-west, the latter range being somewhat the nearer of the two. Below the pass I saw some magnificent yellow poppies, one of which measured 6½ inches in diameter. I was unsuccessful in my search for Takin, though many tracks some months old were visible. On this trip I saw game birds of many kinds: snipe, woodcock, and pheasants of five varieties, as well as partridges and two varieties of snowcock;* there was also a large bird, called *Cha na* in Tibetan and *Huo tan chi* in Chinese, which lives at the snow-line, but I was unable to get a view of it and could not shoot a specimen. Besides tracks of Takin, I found those of serow and musk-deer, and close to Ta-chien-lu I saw three stags which had been taken in the neighbourhood and were kept in captivity. It was said that there were burhel (*Ovis nahura*) on the Boi La To (pass), but, though I spent a day in the search, I did not succeed in finding them. I left Ta-chien-lu finally on May 19, and in five marches reached Ho-kou, or Nyachuka as it is called in Tibetan, where I found a French engineer, M. Kerihuel, engaged in building a suspension bridge over the Yalung river. The next place of importance on the road was Litang, where, by invitation, I stayed in the large lamasery. On June 2 I arrived at Batang, where I was the guest of Mr. and Mrs. Edgar, of the China Inland Mission; and here I was able to obtain cash from a merchant for a cheque on Shanghai.

In company with Mr. Edgar I left Batang on June 6, and was fortunate in having as a companion a man who is not only a keen traveller and observer but has a thorough knowledge of both the Chinese and the Tibetan languages, and whose familiarity with the conditions on this frontier is unsurpassed.

Our first objective was Yen-ching on the Mekong. In some villages on the road we visited schools in which Tibetan children were being taught by Chinese schoolmasters. Such schools have been opened wherever twenty pupils can be collected, and attendance is compulsory for children living near them. Outside the school-house were some simple gymnastic appliances, and a time-table with a list of rules was posted on the door. The subjects taught were geography, history, literature, reading, Chinese, recitation, arithmetic, hygiene, drawing, singing, drill, and science; while the rules for conduct in school were the following: "Don't whisper; don't eat; don't fight; don't speak Tibetan; don't recite '*om mani padme hum*' or other prayers; don't carry knives; don't be dirty; don't dirty the desks." Boys and girls were in separate class-rooms, and the ages of the pupils, who were all doing the same work, varied between four years and twenty; they worked for five hours a day on six days a week.

Chinese influence is making itself felt to a considerable extent in the borderland, as is evidenced by these schools. An attempt is also being made to change the Tibetan names of places and to substitute Chinese names; these latter are in some cases a translation of the Tibetan word,

* See footnote (*) at the end.

but sometimes they are merely a rough transliteration. The people are bound to take Chinese personal names, which so far are only being used by the Chinese in the law courts, but it is hoped that, eventually, they may entirely supplant the Tibetan ones. A list of suitable Chinese names has been drawn up, and each Tibetan can choose whichever of them takes his fancy.

On passing Pamutang a few days after leaving Batang, we made a slight *détour* and crossed the Tibetan frontier by the Ning Ching Shan or Po La, a pass where the Tibetans used to maintain a guard of soldiers. From this pass we saw three distant snow-peaks to the south-west. The pass being unoccupied, we went down to the village of Lanteng (or Lhamdun), where we found a party of Chinese soldiers on the march from Chiamdo. We boiled a thermometer here, and obtained an altitude of 12,727 feet. We recrossed the frontier into China the same day. On June 10 we crossed the Kia La (14,894 feet), from which pass we had a view of the hills across the Mekong, but the top of the range was in cloud. Opposite to us we could see the lamasery of La Gong, approached by the very steep zigzag path up which we were to travel the next day. It was late when we reached Yen-ching, and as we were anxious to cross the bridge at once, we passed the town on our left hand, and descended through the steep valley which separates the plateau of Yen-ching from that of Yerkalo, where there is a French mission station. On reaching the bank of the Mekong, we went a few hundred yards down stream to the rope bridge, which we crossed, and then put up in the village of Jada close to the salt wells. The river was swift, very muddy, and of a reddish colour. As the result of a hypsometrical observation, we found the altitude of the Mekong at the bridge to be 7300 feet. Yen-ching is known in Tibetan as Tsaka, both names indicating that salt is found here. The next morning we went to see the wells. The brine is collected in circular pools about 2 feet deep and 3 or 4 yards in diameter. From these it is taken in birch bark buckets and poured into other and shallower pools underneath drying pans made of earth spread on wooden platforms, which in the distance look like the flat roofs of a large village. Here it is left till, some of the water having evaporated, it becomes stronger. This brine is then poured into the drying pans. The sun beating upon these evaporates all the water, leaving a thin layer of white salt, which is then swept up with a broom; but a good deal of red earth from the pans is mixed with it, and this gives the salt a dirty reddish appearance. It was at this bridge that Major Davis and his companions were turned back in 1900; the lamas fired on the party and eventually cut the rope bridge. These hostile monks came from the lamasery of La Gong, which we passed through the next day. It had been sacked by the Chinese in 1907, and at the time of our visit was in charge of a small guard of Chinese soldiers.

Having successfully passed Yen-ching, we decided to make for Menkong, on the Salween. We left the Mekong on June 11. On our second

day's march we crossed the watershed between the Mekong and the Salween at the Beda La (15,209 feet). There was aconite on the pass, and our transport ponies were therefore muzzled, but we passed an unfortunate man whose pony had eaten the poisonous plant and was dying. He begged us to help him, but we could do nothing, and later in the day he overtook us, his animal having died.

There are said to be stags in the forest near here, but I saw only two gooral. The road up the Beda La was through a forest of fir and pine in which were many beautiful rhododendrons, the lower ones had mauve flowers, while higher up the flowers were white; there were also apricot trees bearing unripe fruit. After crossing the pass, we stopped in the large village of Petu, which M. Bacot had previously visited. This village, with a few outlying farms, has about one hundred inhabitants, besides a lamasery of fifty monks. Our small room was invaded by a friendly crowd of both monks and laymen, to whom Mr. Edgar gave tracts which those able to read devoured with great interest; they frequently tie them along with Tibetan prayers to bridges, or to trees near water or their houses. The women wear a quantity of cheap jewellery. The houses in this neighbourhood are roofed with pine shingles kept in position by heavy stones, while the houses at Yen-ching, those at Wabo further down the Drayul Chu, and also those in the Salween valley at Menkong, have the usual flat Tibetan terraced roofs. The Drayul Chu flows past the Yenchin village; it was crossed by A. K. at Drayul Gompa, some three days' journey further north, and he describes it as being 60 paces wide and 3 feet deep. At Petu it cannot be more than 30 yards wide, and this is also the width at a bridge 3 miles further down-stream, but the depth must be considerably more than 3 feet. This river, as we shall see, performs some wonderful geographical gymnastics before it finally falls into the Salween. Like all rivers of any size in this part of the world, it receives a different name every few miles. At Petu the soil yields two crops a year.

After leaving Petu, we crossed a pass, the Tong La (10,797 feet), only to find ourselves again in the valley of the Drayul Chu, which makes a long bend to the south, and again a smaller loop which we could see in front of us. From the Tong La, distant snows were visible to the south and south-west. Before reaching the village of Wabo, we could see the junction of the Drayul Chu with that of the Salween, though we could not see the actual streams at the bottom of the deep valleys. The country here has a bare, arid appearance, but the tops of the hills show signs of a damper climate, being covered with fir and pine forest; lower down is a thick belt of prickly oak, and below that again a small thorny scrub. There are many villages in which crops of barley were being cut, water being brought from the hills in log troughs. The hills are very steep. At the point where we left the Drayul Chu the river issues from a precipitous gorge, and turns sharply to the north. At the village of Ke, a few miles from this bend, it is about 30 yards wide, and 7480 feet above

sea-level. I obtained a specimen of a snake* near the village of Ke. On leaving the Drayul Chu we crossed the Tondu La (11,240 feet). As we ascended, we passed through the damper zone, where we found the dry-looking shrubs giving place to firs, pines, birches, and rhododendrons, while the ground below them was carpeted with ferns. Our view from the pass to the north was interrupted by the forest through which we had just passed, but that to the south was very striking. The Salween could be seen flowing almost due south, hemmed in by high hills, bare at the base but with a belt of forest higher up, while on the summits were patches of snow with an occasional upstanding snow peak. Spurs came down from the ranges on either side, and the river twisted among these. A few villages could be seen on the banks of the Salween, and the valley running to the river from the pass on which we were standing was well cultivated. After descending steeply from the pass, we reached the village of Lonbo, where we spent the night. The people here were thrashing corn with flails. The next day we were obliged to make a small diversion from the main road to Menkong in order to change our transport animals at the village of Trana. At this point the Salween flows west, but at Trana it takes a turn to the south. The hills are precipitous, with scanty dry vegetation, among which a cactus-like plant, with an orange-coloured flower, was conspicuous.† The Salween is a swift, muddy river, very similar to the Mekong at Yen-ching. We crossed by a rope bridge, and found the altitude of the river-bed to be 6056 feet. It is here called the Gyamo Ngo Chu. A steep climb of 1000 feet from the bridge brought us to the village of Menkong, where we found a small garrison of Chinese soldiers. Apricot and pomegranate trees were growing in the village. Here we found the Tibetans keeping slaves of some race of very small stature (men about 4 feet 8 inches; women about 4 feet 4 inches); they were said to have come from a country which the Tibetans call Tsong, seven days to the south of Menkong. They did not know anything of their own history, they could speak no language but Tibetan, and wore Tibetan dress. They were well treated by their masters. One of the female slaves had a tattoed face. On first reaching Menkong, the Chinese found among the slaves some Chinese whom they liberated, but they allowed the Tibetans to retain slaves who were not Chinese. A mile from Menkong there is a lamasery with about sixty monks, but we were unable to spare time to see it. I was anxious to take an observation for latitude at Menkong, but cloudy weather prevented my doing so. From here Mr. Edgar returned to Batang by the route we had followed thus far together, and I was not to see a white face again until I reached Sadiya. I was sorry to lose my companion, whose experience of travel in the country and knowledge of Chinese were invaluable.

My road lay up the bank of a tributary which joins the Salween at Menkong. There were extraordinarily large numbers of butterflies here,

* Identified by Mr. G. A. Boulenger as *Coluber tæniurus*, Cope.

† Prof. Balfour thinks that this is probably a Euphorbia, perhaps *E. antiquorum*.

almost all of one species, *Neope agrestis*. A steep ascent brought me to a pass, the No La (14,128 feet). The weather was very cloudy, and I could not see much of the surrounding country, but caught a glimpse of snow-mountains to the east. After crossing the range, I found that the streams flowed to a river in a valley lying north-east and south-west. I was unable to determine with accuracy in which direction this river flows; but I think it most probable that it is towards the south-west to join the Irrawady, and that it does not flow into the Salween. The next day, June 17, I had to cross a higher pass, the Tsema La (15,676 feet). On this there was a good deal of soft snow, which caused some trouble to my ponies. The hills around the pass are steep and rocky, the hollows being filled with snow. The weather was cloudy, but I got a brief view of distant snows to the north-west. This pass is closed in winter for animals, but men can always cross it over the snow. After descending from this pass, and following a stream for some miles, I reached a river some 20 yards wide; this is an upper branch of the Irrawady. I asked whether the water did not flow into the Salween, and was told that it did not, but that it went to a country called Lhoka or Tsong. Here the valley of the Irrawady is about 11,500 feet above sea-level. The tops of the hills are grassy, with outcrop of rock, below which is a belt of fir forest, while the bottom of the valley is open grass, on which many ponies and cattle were grazing. There were a few belts of firs or junipers across the grassy valley. I noticed clematis in flower on these trees, and I collected some specimens of Cypripedium orchids (*C. lutea* and *C. tibeticum*). The few habitations are very poor rough huts with roofs of pine shingles, and a few fields are occasionally met with, but the crops are uncertain. I heard the call of the large white pheasant (*Cressoptilon*), but did not see the bird. The saddle-cloth commonly used here is a burhel skin, these animals being found on the surrounding hills. On June 18 I stopped at the village of La Gyap, whence I noticed a snow-peak at the head of a valley to the north. I was told that a place called Gula is situated in this valley. After marching for two days up the Irrawady, I came to the foot of a pass, the Tsong La, where I found a circular lake about 150 yards in diameter, to which a border of rhododendrons gave quite an artificial appearance; I shot a partridge, and noticed both blue and yellow poppies. The main branch of the river I had followed for the last two days was here only about a yard wide, and took its rise in the snow-covered hills to the north of the pass. The Tsong La, which was found by hypsometer to be 14,913 feet high, was clear of snow, though there were some drifts on the roadside. The water west of the Tsong La joins with a stream which flows due south, and must be the headwaters of the Tarawan, which passing through Kamti Long joins the Irrawady.

At the Zhasha La, a pass 15,711 feet above the sea, which I crossed on June 20, I left the Irrawady basin and entered that of the Zayul Chu. On the pass there was very little snow actually on the road. After crossing

it, the road follows down the open valley of a stream which, after about 8 miles, enters a gorge and eventually joins a larger stream at a village called Michi (11,937 feet). This is the place which A. K. visited on April 21, 1882, giving it the name of Rika, which is the name of one of the houses; the village is sometimes called Michi-Rika, but Michi is the commoner name, and I did not hear A. K.'s name for the place until I had made inquiries about it. There are some hot springs here, in one of which I bathed, the temperature being 115° where the water issued from the ground. My next day's march to Drowa Gompa was along the road followed by A. K. twenty-nine years previously. At about 6 miles from Michi I noticed a considerable stream bursting from the hillside on the left bank of the river. Drowa Gompa (8746 feet) is a large village of log huts with roofs of shingles held down by stones. The people about here, and to some extent at Menkong, wear an under-jacket of blue cloth edged with red, which gives it the appearance of a kind of uniform. They carry knives in sheaths of wood, one side being open and the knife held in leather thongs, much as do several of the tribes in the Eastern Himalayas; I once bought a sword in a sheath like this from a Mohammedan who was passing through Tibet on his way from Central Asia to Mecca. The people of south-eastern Tibet carry primitive chopsticks formed of a single splinter of bamboo bent double and kept in the sheath with the knife. These people are great snuff-takers. The snuff-box of south-eastern Tibet is of a peculiar kind; a small circular wooden box has a piece of cloth stretched tightly across the mouth, on the top of which the lid fits; the box is turned upside down and given several sharp taps, which force some of the snuff through the cloth into the lid; this is then removed and the snuff is taken from it. In his table of population A. K. states that there is one lamasery of fifty monks, and twenty-five houses with only five inhabitants; I quite expected that this last statement had been made in error, but I found that, as usual, he was right, and that there were many empty houses. The lamasery now only supports fifteen monks. Finding the people here very friendly, I proposed going to Sanga Chu Dzong, and to this they raised no objection. In this and several other villages I was asked if it was a fact that we were ruled by a woman, and whether it was true that in my country women had much more power than men, who were always obliged to walk, while women were allowed to ride horses.

The road to Sanga Chu Dzong passes up the Zayul Chu in a northerly direction. At Drowa Gompa the river was about 30 yards wide, the water being muddy and of a grey colour. After going up for some miles, I reached a place where the stream narrowed to about 7 yards and flowed partly under the overhanging rocky bank. Here the road crossed to the right bank of the river by a single-span log bridge. At one point a road up a branch of the river leads to a place called Trong-yu. On the left bank, at about 13 miles from Drowa Gompa, there is a fine precipice with a sheer drop of about 1500 feet. The river was a foaming mass of dirty water

the whole way from Drowa Gompa. There are very few villages. The regular stage, at which I stopped on my return journey, is Loma, famous for the wooden bowls which its inhabitants make. Here I saw potatoes growing, and a kind of *dal*, called in Tibetan *Sanchu*, besides barley and peas. The people wished me to go to a place four days' journey to the east, where they said that stags and burhel, with other kinds of game, were very plentiful, but I had not time to do this. As one approaches Sanga Chu Dzong, the road passes through thin forests of fine pine trees in which parroquets * were nesting. Near Sanga Chu Dzong the valley opens out, and there are many scattered farm-houses with much cultivation. This place is called Goschen; and Sanga Chu Dzong, a large group of houses, can be seen on a spur 4 miles to the west. Goschen must be a healthy place, to judge by the number of old people who sit on the roofs of the houses turning prayer-wheels; one intelligent old man told me that he was eighty-two, and had made a pilgrimage to Lhasa sixty years ago. I noticed the horn of a burhel on the roof of a house—the first tangible evidence of the presence of this animal that I had seen for some time. On June 24, at the invitation of the monks, I moved over to Sanga Chu Dzong, traversing the intervening four miles over a plateau covered with scrub, through which two branches of the Zayul Chu cut ravines 500 feet deep. On arrival at Sanga Chu Dzong, I found a crowd of monks, all anxious to get their first sight of a white man. I was housed in a fine brick building close to the monastery. The dzong was deserted and in ruins, as were most of the other houses, but the lamasery was in good repair. There were about seventy monks. In the absence of the abbot, the head monk sent some of the monastery officials to me with a teapot of buttered tea and some boiled rice. I paid a visit to the lamasery, where I was given a meal. There were some fine images in the temple, and a particularly striking row of *chortens* beautifully ornamented. I also saw two copies of the *Tan Jur* and one of the *Kan Jur*, which had been printed at Netang, near Shigatse. In return for their politeness I sent them a photograph of the Dalai Lama, and on my return journey I added one of the Tashi Lama. The valley to the west of Sanga Chu Dzong is well cultivated, and many brick-built farm-houses with roofs of shingles are seen dotted about; the population within a radius of 5 miles cannot number less than five hundred. The river which flows at the base of the spur on which the houses are situated is called the Tsilung Chu. On the most recent maps Sanga Chu Dzong, of which I found the altitude to be 11,693 feet, is placed on a tributary of the Salween, but this is incorrect. The Tibetan Jongpen, who rules this part of the country under the Lhasa Government, had left on account of the arrival of the Chinese. Some months previously he had sent one of his stewards to meet the late Mr. Williamson at Rima; and Mr. Williamson had given this man some Indian tea, which was not used, but was being kept by the monks as a curiosity,

* See footnote (*) at the end.

and some advertisement sheets of the *Pioneer* in which it had been wrapt formed treasures which I was asked to explain. The distance from Sanga Chu Dzong to Lhasa is covered in from twenty to thirty-two days.

On June 26 I left Sanga Chu Dzong. The road passed up the valley of the Tsilung Chu. The bottom of this valley is cultivated for about five miles up-stream, while the hills are covered with a forest of firs, birches and poplars. Opposite the village of Dendon, up a valley to the south-west, I saw a glacier with, as I thought, a stream flowing from it, but I was afterwards to find out that this stream breaks through the range in a surprising manner. The day after leaving Sanga Chu Dzong I crossed the Jo La, a pass 16,307 feet above the sea. This was the first day of clear weather since my departure from Batang. For about half a mile there was deep, soft snow, over which my ponies struggled with great difficulty. Looking back from the pass, I could clearly see Sanga Chu Dzong and the farm-houses of Goschen, and I also had a view for many miles down the valley of the Zayul Chu up which I had travelled. The valleys were all thickly wooded, and the tops of the more distant hills were rocky, with some snow, while those which were nearer to me, and from which several small glaciers emerged, were covered with snow, except where the rocks were too steep to retain it. Owing to the lie of the ground, I could not see anything to the north-west, but after crossing the snow I had a good view. In that direction the country presented an appearance very different from that of the country which I had left; and it was at once evident that its climate is much drier, as the hills were bare of all vegetation except grass and very small shrubs. A stream was seen flowing in a broad open valley. As I was on the top of a high snowy range, I naturally thought that this stream rose in the range and was flowing away from me to the N.W.; but, on reaching it, I was surprised to find it flowing towards me, and was told that it breaks through the range and comes out at the village of Dendon, where I had previously seen it. On leaving the pass I observed some large snowfields and peaks, quite near, to the south and south-west, and saw the stream flowing into a gorge among rocks, snows, and glaciers. It would be interesting to follow its course through the hills, where some remarkable scenery would be met with, but there is no road. The altitude of the point where the stream enters the gorge must be about 15,000 feet. Some miles from the pass another surprise greeted me, for I came on a small sluggish stream flowing north-west. There is a very flat watershed between the Nagong Chu, which flows past Shiuden Gompa, and the Tsai-lung Chu branch of the Zayul Chu, which flows past Sanga Chu Dzong. After following this small stream for a short distance, I found that it was reinforced by water from a valley to the south in which there are three glaciers. I camped in a cave which can be recognized by the smoke-blackened entrance. Just before this, a valley from the north leads to the Dama La, over which lies an alternative route from Sanga Chu Dzong, used only when the Jo La is closed by snow. The bottom of the valley here was two miles

wide and covered with brushwood, in which there were a great many hares and partridges; I also caught many butterflies, including three species of *Coleas*, and saw a pair of ruddy sheldrakes and some redshanks, which were breeding. Near the Jo La there were also many marmots, one of which was caught by a dog which had attached itself to me. Here I noticed a blue poppy, since identified as *Meconopsis rudis*, Prain, var. *Prattii*. I continued on down this valley, which gradually got wider and more broken until I was descending through low hills with a few scattered firs and juniper trees, among which hares swarmed. Finally, I came in sight of the Ngam Tso. This is a lake about four miles long by one mile wide, narrowing at one part, over which the bridge described by A. K. has been built. The lake is very shallow at the southern end. On the flats which border it are many fields and some farm-houses, while Shiuden Gompa, a cluster of buildings, is on a hill 400 feet above the water and 13,685 feet above sea-level. I went up to the gompa, and was met by a dirty goitre-stricken monk, who combined the duties of head of the lamasery with those of the civil officer of the district of Nagong. From the gompa a large and dirty glacier can be seen descending to the southern end of the lake. The road to the Ata Gang La passes the glacier, and it was by this road that A. K. travelled when he came to Shiuden Gompa after turning back from Rima. Above the lake is a high rocky conical peak. The river which leaves the lake here flows to the west, but I was unable to find out for certain whether it joins the Tsang Po or turns southward to India before reaching that river. In fact, the country between Shiuden Gompa and the Tsang Po is so wild and disturbed that the people of Nagong, the district of which Shiuden Gompa is the capital, never visit it. The women in this part of the country wear a single large turquoise set in silver on the hair, which is plaited in a queue.

I visited the monastery, which holds about seventy monks. It is similar to that at Sanga Chu Dzong, but not quite so fine. The official would only allow me to go in one of two specified directions: I could either go to Chiamdo or return by the way I had come; and I decided to return, as I wished to be back in India by the end of July. Here I succeeded in taking an observation for latitude, and found it to be 29° 28′ 7″. On reaching a stream on my return journey, I was dismayed to find one of my mule drivers above his waist in glacier water, trying to recover a crumpled mass which I recognized as the water-tight tin box containing my small collection of bird skins. There was another box lying in the water, which did not concern me so much. For several days I did my best to dry the skins which, though rather bedraggled, I hoped were not altogether spoilt; the accident was caused by a pony falling off a rickety bridge. Passing Drowa Gompa again on July 3, I arrived the same evening at Chikung, where I found a Chinese garrison of soldiers under an officer. We exchanged visits, and he was most friendly, treating me to a bottle of champagne. The soldiers besieged me for medicine, of which I distributed some

quantity, treating each case according to the instructions in 'Hints to Travellers'; I sincerely hope that no harm resulted.

The road I followed on this and the two following days down to Rima was that along which A. K. had travelled in 1882. I found an Indian slave with the Chinese at Chikung. He had been captured by the Mishmis, who sold him to the Tibetans, but the Chinese had released him; I offered to take him with me to India, but he would not come. The road from Drowa Gompa to Rima follows the Zayul Chu. There is very little cultivation, though the soil appears to be adapted for it. At one point, opposite to the village of Dabla, there is a fine, almost sheer face of rock, standing up about 1000 feet above the left bank of the stream. The roadway is very bad; in places galleries are built round the cliffs, and in others sticks have been fixed horizontally across the smooth rocks to give ponies a foothold. Near Rima the valley widens out considerably, and a large river, the Rong To Chu, joins the Zayul Chu from the north-west. The combined river is called the Ngo Chu by the Tibetans. About a mile north of Rima is the village of Shika. This used to be the headquarters of the Tibetan officials, while Rima was the village in which the local peasants lived. I saw many rice-fields here, and also maize, while apricot trees were bearing unripe fruit; there were a few Chinese soldiers who had grown various Chinese vegetables successfully.

I reached Rima on July 5. I was much disappointed to find that boots were unknown here, as I had hoped to be able to replace mine, which were quite worn out. I took two observations for altitude with the hypsometer, and found it to be 4839 feet; A. K. made it 4650 feet. Snow falls here in winter; the temperature in the shade was 91° at 4 p.m., and in a very open room by a window the minimum was 71° at night.

The inhabitants of Rima are different from those of the other parts of south-eastern Tibet through which I had just passed. They cut their hair short and do not wear a queue; elsewhere in south-eastern Tibet the people never smoke, though they take quantities of snuff, but at Rima tobacco is both grown and smoked. The inhabitants of Rima are very much cut off from the rest of Tibet; they never make the usual pilgrimage to Lhasa or other holy places, and, although professedly Buddhists, are very lax in their religion; when I was in pursuit of Takin I saw a man sacrificing a fowl in order to bring him luck. The form of marriage among them is that "by capture"; the bridegroom goes with his friends to the house of the bride, where the men of both parties quarrel and fight for a time; the quarrel is then made up, all feast together, and the couple are considered to be man and wife. I had noticed that the people of Sanga Chu Dzong and at several other places wore coats made of the skins of gooral of a foxy-red colour, which were said to come from the neighbourhood of Rima. I made inquiries about this, and was told that these animals were plentiful in the hills down-stream from Rima.

One day's march down the river brought me to Kahap, which is called

Kanau on the R.G.S. map of Tibet. Mosquitoes and biting flies were troublesome here. Ponies cannot travel on the road down from Rima, as in many places the track climbs over cliffs and up notched logs, near which a rope of creepers is usually fastened to help the traveller. From Kahap I went two days' journey into the hills to the east over awful roads, and here found a hot spring where a herd of about three hundred Takin (*Budorcas taxicolor*) come every night and morning to drink. I returned to Kahap after having shot six of them. At one place in this valley I crossed drifts of old dirty snow at an altitude of less than 10,000 feet. A pass at the head of this valley, between 30 and 40 miles from Kahap, leads to a country which the Tibetans call Cho, where a people similar to the Mishmis live. From Kahap I marched to Tinne, where a rope bridge spans the Lohit river. The river was about 80 yards wide, and very rapid and muddy. At Tinne I met some Mishmis, from whom I heard for the first time of the murder of Mr. Williamson and Dr. Gregorson. Plantains and tobacco were grown at this village.

From Tinne I travelled down the Lohit, passing through the Mishmi country. At a village called Krang, about 22 miles below the great bend in the river, I lost my compass, and was therefore obliged to discontinue the route survey which I had kept up since leaving Yen-ching on the Mekong river. The Mishmis are great smokers; their pipes are of bamboo, the tobacco being grown locally and dried in the sun; they also smoke a great deal of opium, which is mixed with sacking and smoked in a roughly made bamboo pipe. The Mishmi carries a flint and steel somewhat similar to that used by the Tibetans; pine torches afford his only artificial light, and towards the end of our marches my coolies used to search among the driftwood on the river-bank for a log of resinous pine from which to make them. The chief article of food in the country is maize, but I also got a few sweet potatoes and unripe plantains, which, when cooked, are quite an eatable vegetable. Every evening a mist about fifty feet thick used to hang above the water, and when the road dropped into this, I noticed a fall in temperature, while on rising out of it I felt as though entering a hot-house. I reached Tashalun, the Mishmi village nearest to the Indian frontier, on July 29. Here, to my disappointment, I found that the usual road to Sadiya was impassable owing to the swollen condition of the river, and that I should be obliged to cut my way through the jungle at the foot of the hills where the streams were smaller. I spent a day in this village, as the coolies had to prepare food for several days in advance. The chief house of the village was a very long narrow bamboo building, raised about four feet from the ground, and divided into cubicles, in each of which one family lived. A fire was lit in the middle of each cubicle, and three long logs, which met in the fire, were gradually moved in as they burnt away, the parts of them lying across the room being used as pillows. Some of the Mishmi villages further into the hills were surrounded by a bamboo palisade with sharpened spikes on the door. The Mishmis cover the walls of their houses with the skulls of cattle and other animals; the house in which I stopped at Tashalun

showed over seventy such skulls, all, with one exception—a deer—being those of domestic animals. Eight days' travelling from Tashalun brought me to Sadiya. I was obliged to cut through a virgin forest for most of the way, and to ford many rivers; but sometimes my Mishmi coolies would fell a tree to bridge a small deep river. At one place I only made a quarter of a mile after cutting through the jungle for an hour and a half. Leeches were very troublesome; I have never seen them worse. I saw tracks of many varieties of game, including elephant and buffalo, and at one of my camps in the hills the coolies asked me to sleep with my rifle at hand, as they had heard a tiger prowling round. On my last day's journey into Sadiya, I voyaged down the river in a narrow dug-out canoe. At Sadiya I was the guest of Mr. Dundas and Captain and Mrs. Robertson.

Goitre is a very common disease all over south-eastern Tibet, and is not uncommon among the Mishmis. At the time of year at which I was travelling, the weather was most unfavourable for survey work. Clouds nearly always obscured the higher hilltops, and rain fell frequently, while in winter many of the passes are closed by snow. Consequently, this must always be a difficult country to survey. In July and August the minimum temperatures at night in the Mishmi country varied between 61° and 76°. I found the Mishmis difficult to manage, but, luckily, had some opium with me, for which drug a Mishmi will do a great deal. I carried no tent, but in Tibet I usually slept in a house, and in the Mishmi hills the people rigged me up shelters of plantain leaves. A word in praise is due to my Tibetan servant, Putamdu, who, having on my summons gone down to Calcutta, had been shipped out to China by Thomas Cook, and accompanied me throughout my journey from Peking to Sadiya. I brought back a small collection of about sixty skins of birds,* with the eggs of several species, and the skins of a few small mammals.† I had also about two thousand specimens of butterflies,‡ besides two hundred moths and a few other insects.

The latitude of Shiuden Gompa was determined with a 6-inch sextant, and all heights were taken by hypsometer. I am indebted to the Royal Geographical Society for the loan of these instruments, and to the Survey of India for their kindness in working out the results of my observations.

* Mr. Ogilvie Grant says that special mention may be made of the rare Koslow's Scimitar-babbler (*Babax koslowi*) and a small brownish warbler or chiff-chaff, believed to be *Phylloscopus homeyeri*, neither of which species was represented in the Natural History Museum. Other rare species are Lord Derby's parroquet (*Palæormis derbyensis*) and Széchenyi's pheasant grouse (*Petroophasis szechenyii*), with other game birds. Among these last he has identified five pheasants (*Crossoptilon thibetanum*, *Thaumalea amherstiæ*, *Phasianus elegans*, *Ithagenes geoffroyi*), and a Tragopan; a partridge (*Perdix sifanica*); and a snowcock (*Tetraogallus tibetanus*).

† Mr. Oldfield Thomas states that two of the mammals proved to be new—a mole-rat (*Myospalax*) and a mouse-hare (*Ochotona*). These have been named, respectively, *M. baileyi* and *O. roylii chinensis*.

‡ The working out of the collection of butterflies is not yet completed, but it seems probable that it comprises from 150 to 170 different species, of which perhaps a dozen or so may prove to be new.

I add an itinerary of my march from Wan-Hsien, on the Yangtse, to Sadiya:—

Marches.	Dates.	Days.		Miles.
		Marching.	Halting.	
Wan-Hsien to Chengtu	April 9–22	14	—	400
Halt at Chengtu	,, 23–26	—	4	—
Chengtu to Tachienlu	April 27 to May 9	13	—	255
Halt at or near Tachienlu	May 10–18	—	9	—
Tachienlu to Ho-kou (or Nyachuka) ...	,, 19–23	5	—	80
Halt at Ho-kou	,, 24	—	1	—
Ho-kou to Litang	,, 25–28	4	—	80
Litang to Batang	May 29 to June 2	5	—	145
Total—Wan-Hsien to Batang	April 9 to June 2	41	14	960
Halt at Batang	June 3– 5	—	3	—
Batang to Menkong	,, 6–15	10	—	174
Menkong to Drowa Gompa	,, 16–21	6	—	93
Drowa Gompa to Shiuden Gompa ...	,, 22–27	6	—	80
Halt at Shiuden Gompa	,, 28	—	1	—
Shiuden Gompa to Rima	June 29 to July 5	7	—	123
Halt at Rima	July 6	—	1	—
Rima to Sadiya	July 7 to August 7	28	4	285
Total—Batang to Sadiya ...	June 3 to August 7	57	9	755
Grand total—Wan-Hsien to Sadiya ...	April 9 to August 7	98	23	1715

THE CLIMATIC LIMITS OF WHEAT CULTIVATION, WITH SPECIAL REFERENCE TO NORTH AMERICA.*

By J. F. UNSTEAD.

The object of this inquiry is to determine the limits of wheat cultivation which are set by climatic conditions, and to apply the conclusions obtained to the special case of North America. At the present time the actual limits are seldom set by physical controls. For example, such economic factors as facilities for transport and the supply of labour are the chief determining factors in the north-west of Canada, and the construction of railways and the increase of settlers will at once be followed by an extension of the wheat area. Such extensions, however, tend to make the actual and ultimate limits coincide, and the latter are determined by physical controls. The ultimate limits cannot be estimated in any definite and final manner, for they are subject to change as man obtains a greater knowledge of agricultural methods, including not only management of the soil and selection of the best times for farming operations, but also the breeding of new varieties of plants specially adapted to conditions found

* Thesis approved for the degree of Doctor of Science (Economics) in the University of London. Research Meeting, March 21, 1912. Map, p. 420.

near or on the margin of cultivation. Hence, in this inquiry an attempt is made only to state the present climatic requirements for wheat cultivation, and to indicate somewhat broadly the limits beyond which cultivation is unlikely to extend in the more immediate future.

Among the physical controls, the climatic conditions are of the greatest importance, for soil conditions have a more limited and local control, and are more amenable to human modification; accordingly, the two chief factors are considered to be heat and moisture.

The Control by Heat Conditions.

In regard to the heat requirements of wheat, the practical problem is concerned with the poleward rather than the equatorward limits, for these latter are set either by the lack of moisture, or by the fact that some other economic plant, *e.g.* maize, can be cultivated, and yields a higher return than wheat, while beyond the poleward limit of wheat is usually grown a crop giving a lower profit, or, as in the case of Canada, little cultivation of any kind is undertaken. Consequently the minimum and not the maximum heat conditions are here considered. The method adopted is first to determine the actual heat requirements of wheat, and then to compare these requirements with the climatic conditions known to exist in certain regions beyond the present limits of cultivation, in order to see whether or not the requirements are satisfied and cultivation is possible.

The life of a plant involves a very large number of processes, and for each process there is a minimum, optimum, and maximum temperature. Thus, germination in wheat cannot take place, according to Detmer, Sachs, and Risler, at a lower temperature than 5° C., though Schimper * states that this figure is too high. This function proceeds more rapidly as the temperature rises until about 29° C. is reached, but with a further increase of temperature the rate diminishes, and germination ceases altogether when the temperature reaches about 42° C. The other functions have their own minimum, optimum, and maximum temperatures, but at each stage of development there is a certain temperature which is most favourable to the plant as a whole. This optimum temperature rises during much of the life of the plant, though certain processes, *e.g.* flowering, may cause the optimum to be lowered when the particular processes assume importance.

If allowances are made for the varying efficiency of different temperatures, for the changes of the optimum at different stages, and for the influence of factors other than heat, it may be said that each species of plant needs a certain total amount of heat to bring about its full development. This total amount of heat might be measured by taking into account the two factors, (1) the temperatures to which the plant is exposed, and (2) the time over which they extend. But no such calculation can be made with accuracy, for very little exact knowledge has been obtained as to the varying efficiency of different temperatures, the changes in the optimum, or the influence of other factors. Therefore no attempt to

* A. W. F. Schimper, 'Plant Geography upon a Pysiological Basis,' p. 46.

measure the heat requirements of plants as a simple sum of temperatures can be precise, and any results can have only an empirical value.

Yet it seems that some such empirical value does exist, and the method of calculating accumulated temperatures by "day-degrees" has long been employed. A temperature of 5° C. (or by some investigators, 42° Fahr.) is taken as the lower limit for growth, and the excess of the mean daily temperature above that minimum is calculated. This gives the number of degrees by which the mean temperature exceeds 5° C. for a period of one day, and each of these degrees is therefore termed a day-degree. The day-degrees between the times of germinating and ripening are then added as a measure of the accumulated temperature. The dates of sowing and reaping of wheat at the experimental farm at Rothamsted, in Hertfordshire, have been kept for many years, and have been correlated with the temperature observations by the late Sir J. H. Gilbert,* and more recently by R. H. Curtis of the Meteorological Office, who thus summarizes his results: † "The mean amount of accumulated temperature above 42° Fahr. required for the growth and ripening of autumn-sown wheat is shown by my calculation to be 1961° Fahr.; the maximum amount is 7 per cent. in excess of this figure, and the minimum, which comes from the data for the last year, 1903–4, is 8 per cent. below it. But whilst the time interval between sowing and ripening varies in different years by as much as seven weeks, which is 17 per cent. of the average period, the differences in the amounts of accumulated temperature are within 2 per cent. of the average in sixteen out of the twenty-eight years dealt with. In eight of the remaining years it amounts to or exceeds 5 per cent., so that, speaking broadly, one may say that the divergencies from the average, when not trifling, are rather large. This I believe to be due to the modifying effect of other elements, such as rainfall or sunshine, which have to be considered in conjunction with temperature, and whose incidence separately or combined was more or less abnormal in these years."

It would therefore appear that, apart from the influence of factors other than heat, wheat requires accumulated temperatures amounting to about 1100° C. or 1960° Fahr. for its development in south-eastern England, but the important question remains whether this is true in respect of other regions.

The Dominion of Canada has maintained five experimental farms where the dates of sowing and ripening of wheat have been recorded for a number of years, and these dates have been utilized in the present inquiry. The method of calculation here adopted differs in two or three respects from that described above. Thus, 5° C. (corresponding with 41° Fahr.) has been taken as the lower limit, and the temperatures above this have been calculated and expressed in degrees Centigrade; also the meteorological data for daily means are not available, and only the monthly means can

* 'Relations entre les sommes de température et la production agricole.' Archives des sciences physiques et naturelles. Geneva, 1886.

† *Symons' Meteorological Magazine*, August, 1905.

be obtained. This seriously affects the precision of the results, but it is less to be regretted, as averages for a number of years both for dates and temperatures have been employed, and thereby errors tended to be cancelled; moreover, the results have to be applied to regions at present uncultivated, and for these the meteorological data can be obtained only in the form of monthly means. This consideration as to the later employment of the results limits the inquiry to the case of spring-sown wheat, for in the regions on the margin of cultivation autumn-sown wheat (frequently termed "winter wheat") is killed. The following table,* with the diagram in Fig. 1, exhibits the method of calculation:—

EXPERIMENTAL FARM AT OTTAWA.

Years	1895-1905, inclusive.
Variety	Red Fife.
Average date of sowing	April 25.
Average date of ripening	August 10.
Period of growth	108 days.
Accumulated temperature	1330° C.

Month.	Mean temperature of whole month.	Days of growth.		Mean Excess above 5° during these days.	Accumulated temperature.
	Deg. C.				Deg. C.
April	6·0	6	×	5·0	30
May	13·8	31	×	8·8	273
June	18·2	30	×	13·2	396
July	20·6	31	×	15·6	484
August	18·9	10	×	14·7	147
					1330

It is to be noted that these facts relate to one variety, the Red Fife, which is the standard variety grown in this part of Canada, but many varieties are grown at the Experimental Farm, some giving markedly different results. Seed has been brought from many parts of the world to test the advisability of its introduction to Canadian farmers. Among others, early ripening varieties are much desired, and for this reason seed has been obtained from Northern Russia and the Himalayas. For example, the Russian variety Ladoga ripened, on an average of several years at Ottawa, eight days before the Red Fife, and required accumulated temperatures of about 120° C. less than the Red Fife. Selective breeding has been applied to these varieties, and very valuable results have also followed from cross-breeding. Thus, a Russian variety from near Archangel crossed with one from the Himalayas at an altitude of 11,000 feet gave rise to the Early Riga strain which ripened at Ottawa about twelve days earlier, and required accumulated temperatures of about 180° C. less, than Red Fife.

* All the dates relating to wheat cultivation at the Canadian Experimental Farms have been compiled from the Annual Reports from 1896 to 1907 of the Director of the Experimental Farms to the Minister of Agriculture, published in the Sessional Papers of the Dominion.

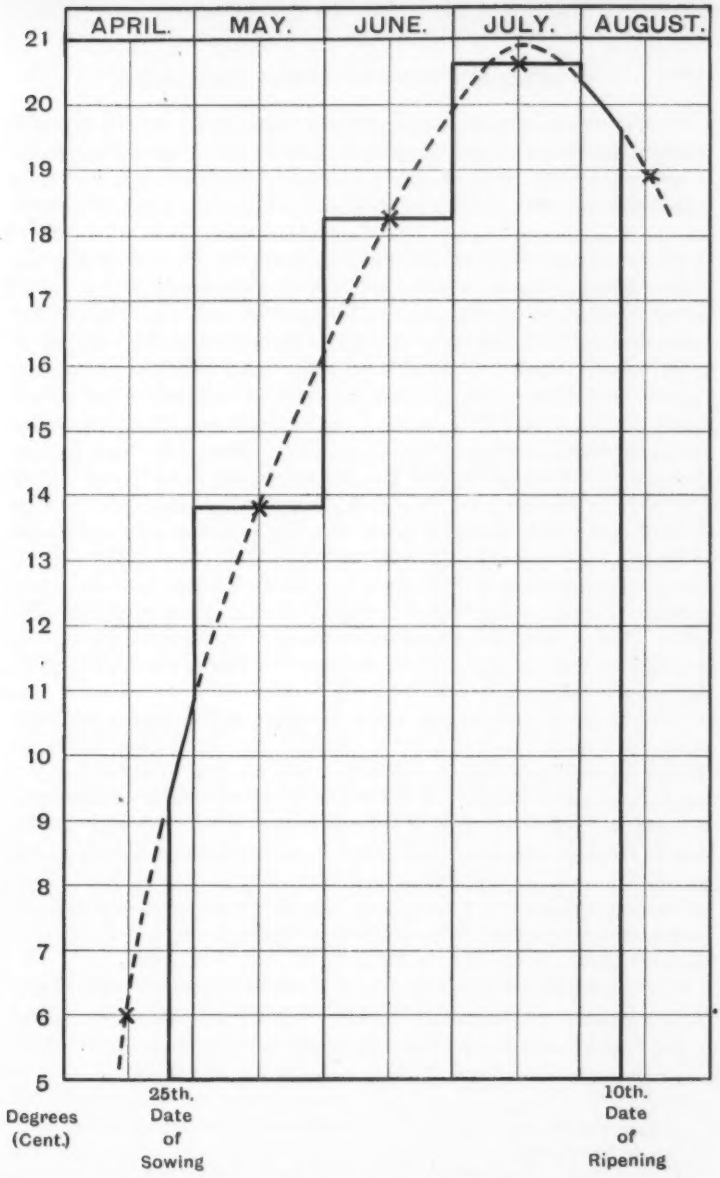

FIG. 1.—DIAGRAM SHOWING THE METHOD OF DRAWING THE MEAN MONTHLY TEMPERATURE CURVE, HAVING GIVEN THE MEAN MONTHLY TEMPERATURES INDICATED BY THE CROSSES.

As the mean temperature for July is 20°·6, the curve must lie above the 20°·6 line in the hottest part of the month, and below it in the cooler parts.

The dates of sowing (April 25) and ripening (August 10) also having been given, from these data are calculated—

(1) The approximate temperatures at the times of sowing and ripening, 9°·3 and 19°·6 respectively;

(2) The accumulated temperatures, 1330°, represented by the area enclosed within the continuous lines.

Yet at Ottawa these varieties compared unfavourably with Red Fife in other respects, and their cultivation is more suited to regions with lower temperatures. The standard variety for Ottawa is therefore selected above, and in the case of the other stations considered later, the standard varieties for the respective regions have also been taken.

It is impossible to compare the accumulated temperatures at Rothamsted and Ottawa, for they relate to autumn-sown wheat and spring-sown wheat respectively, but information as to dates of sowing and ripening has been obtained from the other Canadian experimental farms (Nappan in Nova Scotia, Brandon in Manitoba, Indian Head in Saskatchewan, and Agassiz in British Colombia), from reports upon Dunvegan * and Vermilion † in Alberta, and Chippewyan ‡ in the North-west Territories; also from experimental stations of the United States (Fargo § in North Dakota, Bozeman ‖ in Montana, St. Paul ¶ in Minnesota, and Sitka ** and Copper Centre †† in Alaska). To these data from North America, the average dates of sowing and reaping of spring wheat in twelve provinces of Russia in Europe have been added ‡‡, and in all cases the mean monthly temperatures of the periods in question have been obtained, either from the actual stations or from meteorological returns relating to the respective districts. The accumulated temperatures above 5° C. during the period of growth have been calculated as in the case of Ottawa, and are shown in the opposite table.

The localities have been arranged according to the accumulated temperatures required, and it will be observed that at Copper Centre in Alaska the number of degrees is less than half the number at South Kherson in the south of Russia. It is obvious, therefore, that it is impossible to apply the figures relating to any one station to other regions. Reference to the table also shows that there is no direct connection between the period of growth and the accumulated temperatures, for the shortest and the longest periods of 96 and 137 days respectively are associated with the least accumulated temperatures, and similar contrasts are to be observed if the facts relating to the stations lower on the list are examined.

Contrasting the stations requiring the smaller and greater accumulated temperatures respectively, it will be noted that the former are in regions

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* 'Through the Mackenzie Basin.' By C. Mair. 1908.

† 'Experimental Farms Report,' 1908.

‡ 'Report and Evidence of Committee of the Senate on the Resources of the Great Mackenzie Basin,' 1888.

§ Letter from J. H. Sheppard, of the Agricultural Experiment Station, North Dakota.

‖ Letter from A. Atkinson, of the Experimental Station, Bozeman.

¶ Letter from C. P. Bull, of the Experimental Station, St. Paul.

** Letter from A. C. True, Director of the Experiment Farm at Sitka.

†† 'Report of Experiment Stations in Alaska,' 1905.

‡‡ Paper on "Climate," by A. J. Voeikov, in *Industries of Russia* (vol. 3, *Agriculture and Forestry*). St. Petersburg: 1893.

with lower summer temperatures than the latter. By dividing the accumulated temperatures by the number of days of growth, the mean temperatures above 5° C. are found, and by adding 5° to these results the mean temperatures above zero of the periods are obtained; these are shown in the last column of the table.

A relationship between the mean temperatures of the period and the necessary accumulated temperatures is suggested by the figures and examined by aid of the diagram in Fig. 2, in which the conditions at each station are plotted by measuring the accumulated temperatures horizontally and the mean temperatures vertically. Were there no relationship whatever between the two conditions, the crosses representing the

Locality.	N. Lat.	Date of sowing.	Date of reaping.	Days of growth.	Accumulated temperature.	Mean temperature.
	°				deg. C.	deg. C.
Copper Centre, Alaska	62	May 10	Aug. 14	96	734	12·6
Sitka, Alaska	57	,, 3	Sept. 17	137	841	11·1
Dunvegan, Canada ...	56	April 15	Aug. 15	122	930	12·6
Vermilion, Canada ...	58	May 8	,, 27	111	948	13·5
Chippewyan, Canada ...	59	,, 20	Sept. 20	123	974	12·9
Nappan, Canada ...	45	,, 8	Aug. 28	112	1093	14·7
South Vologda, Russia	60	March 19	,, 27	100	1100	16·0
Agassiz, Canada ...	49	April 16	,, 15	121	1120	14·3
Kostroma, Russia ...	58	May 21	,, 27	98	1135	16·6
Ufa, Russia	58	,, 21	,, 27	102	1157	16·3
Viatka, Russia ...	57	,, 22	,, 27	97	1171	17·1
Fargo, U.S.A.	47	April 29	,, 8	102	1191	16·7
North Simbirsk, Russia	55	May 11	,, 17	98	1251	17·8
Indian Head, Canada	50	April 24	,, 28	126	1293	15·3
Bozeman, U.S.A. ...	46	May 1	Sept. 3	125	1293	15·4
Brandon, Canada ...	50	April 28	Aug. 26	120	1294	15·8
Poltava, Russia ...	50	,, 12	,, 1	111	1297	16·7
Ottawa, Canada ...	45	,, 24	,, 11	108	1330	17·3
Don Territory, Russia	49	,, 11	July 27	107	1387	18·0
South Samara, Russia	52	May 8	Aug. 13	97	1390	19·4
Veronezh, Russia ...	52	April 21	,, 6	107	1406	18·1
Bessarabia, Russia ...	47	,, 12	,, 1	111	1436	18·0
North Taurida, Russia	47	March 26	July 27	123	1469	16·9
St. Paul, U.S.A. ...	45	April 7	Aug. 7	122	1509	17·3
South Kherson, Russia	49	March 31	,, 1	123	1547	17·6

conditions at the stations would be distributed without any system; were the relationship absolute so that one condition depended entirely upon the other, the crosses would fall along a straight line such as that shown in the diagram or along a simple curve.

It appears that some relationship exists, for the successively higher mean temperatures are, on the whole, associated with successively higher accumulated temperatures. This is in accord with other observations in regard to which Schimper says (p. 49): "If we compare individuals of the same species in climates of different temperatures, we soon become convinced that certain functions in hot climates are associated with higher temperatures than in cold climates."

On the other hand, the diagram shows that there are wide departures

from the straight line. These departures may indicate that another factor is present which has not been taken into account. To discover this, the greatest deviations from the general rule may be examined. Copper Centre and Dunvegan have the same mean temperature while differing widely in respect of the accumulated temperature, and a reference to the above table shows that Copper Centre is in 62° N. lat., while Dunvegan is in 56° N. lat. Again, Viatka and North Taurida have only slightly different mean temperatures but widely different accumulated temperatures, and in this case

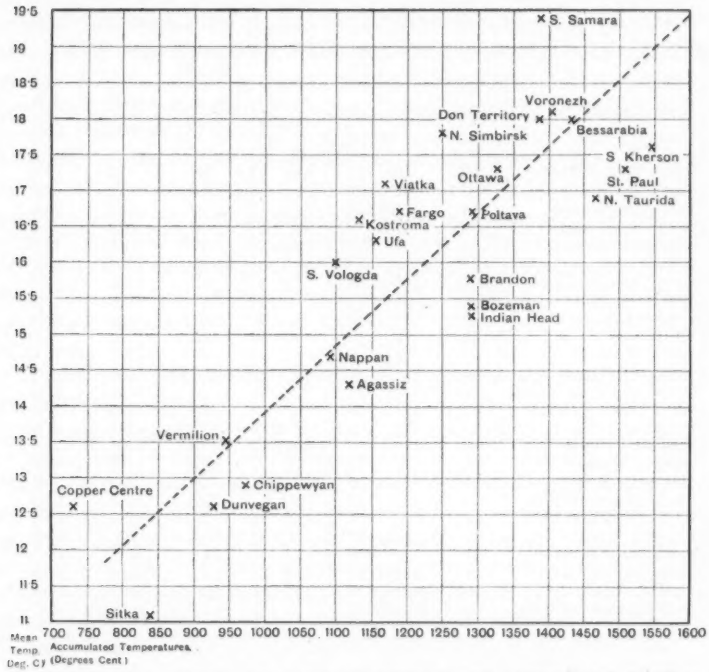


FIG. 2.—DIAGRAM SHOWING THE RELATION BETWEEN THE ACCUMULATED TEMPERATURES REQUIRED FOR WHEAT AND THE MEAN TEMPERATURES OF THE PERIODS OF GROWTH.

Viatka is in lat. 57°, while North Taurida is in lat. 47°. Similar contrasts are to be observed in the case of North Simbirsk and South Kherson, and the suggestion is that a smaller accumulated temperature is required in the higher latitudes. The reason is not far to seek, for in the higher latitudes the summer days are longer, and in regard to this Dr. Saunders, the Director of the Canadian Experimental Farms, says in his report for 1903: "The influence of increased periods of light hastens the ripening of cereals very much. This view is supported by facts brought together during a careful series of observations made some years ago by a

distinguished Russian investigator, Kowalewski. . . . This author attributes the early ripening [in the north of Russia] largely to the influence of light during the long summer days."

In order to examine the influence of this factor, the total duration of light during the growing period at each station was calculated in the same way as the accumulated temperature,* and from these the mean daily duration of light was obtained. The results are set out in the table below. The question then arose as to whether allowance should be made for the reduced intensity of the insolation in the higher latitudes, but this seemed unnecessary in view of the fact that recent experimental work has led to the conclusion that "we can reduce the intensity of ordinary summer sunlight to a very considerable degree . . . without sensibly diminishing the rate of photo-synthesis"†, and other functions, *e.g.* the formation of chlorophyll, "obtain their optimum under light of very moderate intensity" (Schimper, p. 58). Moreover, after the longer passage of solar radiation through the atmosphere of higher latitudes, it comprises a larger proportion of the less refrangible red and yellow rays. These play the chief part in the processes just mentioned, while the blue and violet rays, in which the insolation of higher latitudes is poor, exert a retarding influence on growth (Schimper, pp. 59 and 60). Hence the less intensity of the insolation in higher latitudes would seem to be relatively unimportant, and any effects negatived by the more efficient quality of the rays.

To return to the cases considered above, it is seen that the lower accumulated temperature at Copper Centre, as compared with Dunvegan, is accompanied by a mean duration of light of 18·4 hours, as compared with 16·5 hours; again, Viatka has a mean duration of light of 16·8 hours, as compared with 14·9 hours at North Taurida, and a similar, though less, difference is found in the cases of North Simbirsk and South Kherson. Thus, at least in these cases, a greater accumulated temperature is accompanied by a less duration of light. In order that the factors may be more easily correlated, the mean duration of *darkness* is taken, for then the three factors of accumulated temperature, mean temperature, and mean duration of darkness vary in the same direction. It then appears that the greatest accumulated temperatures are required when both the mean temperature and the mean duration of darkness are great, and *vice versâ*. Some method of associating the mean temperature with the duration of darkness is required in order to show their combined relation with the accumulated temperatures, and the empirical method of adding the number expressing the degrees of mean temperature to that expressing the hours of mean duration of darkness has been adopted. In this way an "index number" for each station has been obtained, and is stated in the last column of the following table:—

* The calculations were based upon the figures published in the 'Meteorological Tables' of the Smithsonian Institution.

† Dr. Brown, in the 'Bakerian Lecture' before the Royal Society, 1905.

Locality.	Accumulated temperature.	Mean temperature.	Duration of light.		Duration of darkness. Mean.	Index of mean temperature plus mean darkness.
			Total.	Mean.		
	deg. C.	deg. C.	hrs.	hrs.	hrs.	
Copper Centre, Alaska	734	12·6	1771	18·4	5·6	18·2
Sitka, Alaska	841	11·1	2232	16·3	7·7	18·8
Dunvegan, Canada ...	930	12·6	2012	16·5	7·5	20·1
Vermilion, Canada ...	948	13·5	1898	17·0	7·0	20·5
Chippewyan, Canada ...	974	12·9	2030	16·5	7·5	20·4
Nappan, Canada ...	1093	14·7	1676	15·0	9·0	23·7
South Vologda, Russia	1100	16·0	1750	17·5	6·5	22·5
Agassiz, Canada ...	1120	14·3	1879	15·4	8·6	22·9
Kostroma, Russia ...	1135	16·6	1668	17·0	7·0	23·6
Ufa, Russia	1157	16·3	1684	16·5	7·5	23·8
Viatka, Russia	1171	17·1	1628	16·8	7·2	24·3
Fargo, U.S.A.	1191	16·7	1566	15·4	8·6	25·3
North Simbirsk, Russia	1251	17·8	1628	16·6	7·4	25·2
Indian Head, Canada ...	1293	15·3	1960	15·6	8·4	23·7
Bozeman, U.S.A. ...	1293	15·4	1887	15·0	9·0	24·4
Brandon, Canada ...	1294	15·8	1862	15·8	8·5	24·3
Poltava, Russia	1297	16·7	1726	15·5	8·5	25·2
Ottawa, Canada ...	1330	17·3	1624	15·0	9·0	26·3
Don Territory, Russia	1387	18·0	1648	15·4	8·6	26·6
South Samara, Russia ...	1390	19·4	1562	16·1	7·9	27·3
Veronezh, Russia ...	1406	18·1	1711	16·0	8·0	26·1
Bessarabia, Russia ...	1436	18·0	1669	15·2	8·8	26·8
North Taurida, Russia	1469	16·9	1829	14·9	9·1	26·0
St. Paul, U.S.A.	1509	17·3	1813	14·9	9·1	26·4
S. Kherson, Russia	1547	17·6	1868	15·2	8·8	26·4

The relationship between the accumulated temperatures and the index number is shown in the diagram in Fig. 3. As the method of combining the mean temperature and light is empirical, it must be justified by the success of its application to the observed facts, and inspection of the diagram reveals a close connection between the conditions, the deviation from the simple relationship shown by the straight line being relatively small, especially in the lower part of the diagram, which relates to the cooler regions near the margin of cultivation. The correlation between the index numbers and the accumulated temperatures shown graphically in the diagram has been arithmetically calculated by the usual method, and this gives a correlation coefficient of 0·98 (unity representing an absolute correlation)—an extremely high coefficient indicating a very close relationship. As this is based upon twenty-five cases, the probable error is 0·005, which is so small in comparison with the coefficient of 0·98 that it is an assurance of the relationship being an essential and not an accidental one. It is submitted, therefore, that the factors of mean temperature and mean duration of light are very closely correlated with the accumulated temperatures, and that the above method of combining them, although empirical, is reliable. In this connection it is to be recalled that deviations from the straight line in the diagram must be to some extent due to the unavoidable lack of precision both in the meteorological data and in the dates of sowing and ripening upon which the calculations have been based.

As the aim of this inquiry is to discover the regions in which wheat

can be grown, *i.e.*, the regions in which the required accumulated temperatures are obtained, the next step is to determine the date in spring at which the calculation may be commenced and the date in autumn to which it may be prolonged. In this matter the detailed knowledge obtained at Sitka is of importance, for there several varieties of wheat are sown as early as

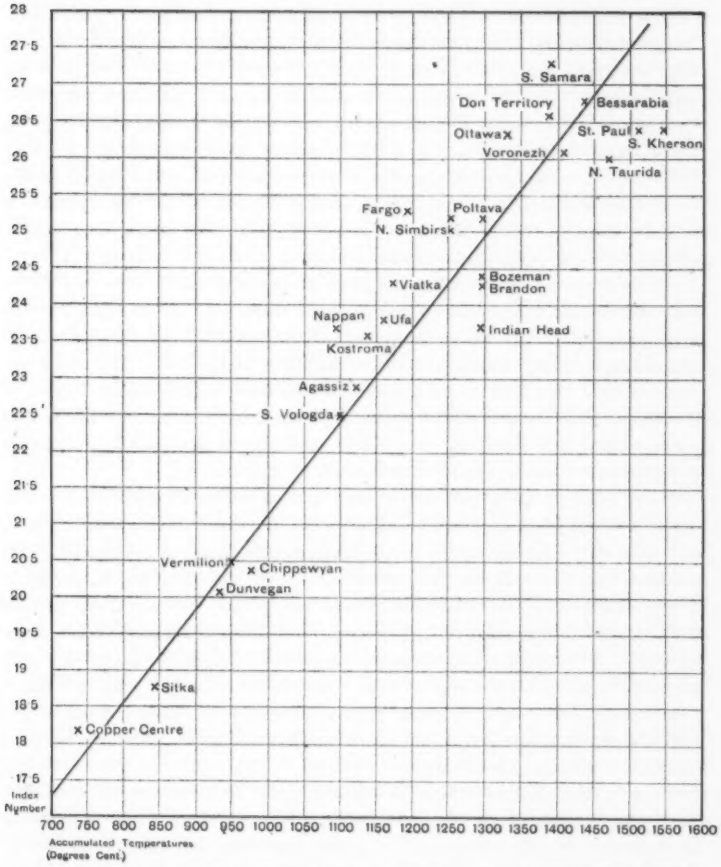


FIG. 3.—DIAGRAM SHOWING THE RELATION BETWEEN THE ACCUMULATED TEMPERATURES REQUIRED FOR WHEAT AND THE INDEX NUMBERS OF MEAN TEMPERATURE PLUS MEAN DURATION OF DARKNESS DURING THE PERIODS OF GROWTH.

possible, and grow until the autumn temperatures are so low that development ceases. Data have been obtained relating to the five years 1899–1903, and for each year the mean monthly temperatures have been plotted and connected by a curve in the manner shown in Fig. 1; these curves

will be referred to as the mean temperature curves. In regard to each year the date of sowing has been marked on the mean temperature curve of the same year, and in each case a temperature of slightly over 5° C. is indicated, showing that sowing can take place soon after the mean temperature (as calculated from monthly means) exceeds 5° C. A difference of one or two degrees in connexion with the time of sowing makes, however, only a negligible addition to or subtraction from the total accumulated temperatures. In regard to the latest time in autumn at which ripening can take place, similar work shows that on the average of the five years the mean temperature curve had fallen to 10·3° C. when the most successful variety of wheat (of the Ladoga strain) was cut. In three of the five years ripening went on until the mean temperature curve had fallen slightly below 10° C. Taking into account, therefore, these minimum temperatures for sowing and ripening, it is concluded that the accumulated temperatures may be calculated from the time in spring when the mean temperature curve reaches 5° C. until the time in autumn when it falls to 10° C.

Here, however, another control must be considered, for in most regions near the margin of cultivation severe frosts may occur before the time just indicated, and if the wheat is not cut before the first of these frosts is experienced it may be killed. The maritime climate of Sitka is exceptionally free from this complication, but over most of the northern part of North America the end of the growing period is determined by the occurrence of the first "killing frost," and at the present time the extent of possible cultivation is practically limited by this control.

But, further, it is well established that after cultivation of the soil summer frosts have occurred much later than before cultivation took place, and over very large areas the frosts have ceased to affect cultivation. In a letter Mr. S. A. Bedford, Superintendent of the Brandon Experiment Farm, writes: "We were troubled somewhat by late summer frosts in this district from fifteen to twenty years ago, but the cultivation of the land appears to lessen the injury from this cause; no doubt the cultivated land gives off heat during the night time." Another authority * states: "Sixty years ago in Kansas and in other parts of the United States further south, they had summer frosts and had them badly, perhaps as badly as Western Canada ever had. They have not had one for fifty years. Twenty-seven years ago, the Mennonites . . . rejected their reservation in southern Manitoba because of the summer frosts. There has not been a summer frost there for eighteen years." In the same article, an experiment is described proving the much higher soil temperature of cultivated land than of adjacent uncultivated land during the night, and similar experiments in England give corresponding results.†

* W. A. Hickman, "The Canadian West and North-West," *Journal of the Royal Colonial Institute*, vol. 34, 1903.

† T. E. Dobson, "Temperature in Cultivated and Uncultivated Soil," *Quarterly Journal of the Royal Meteorological Society*, January, 1911.

There exists no definite knowledge as to the dates of the occurrence of frosts at the present time over most of the regions on the margin of cultivation, but the indications are that this control by frost will ultimately cease to be effective. For example, at Fort Simpson, shown later to be near the margin of cultivation, "wheat is sure four times in five," although the region is liable to frosts and the position of the settlement in the valley of the Mackenzie river would favour the accumulation of the cold and heavy air from the neighbouring upland slopes. The subsequent part of this inquiry therefore leaves out of consideration the occurrence of summer frosts, which must be considered as a separate control subject to considerable change.

With this proviso, it is concluded that *wheat cultivation is possible at stations where the degrees of accumulated temperature, which is experienced between the dates when the mean temperature curve rises above* 5° *C. in spring and descends to* 10° *C. in autumn, amount to the number indicated by the straight line in Fig.* 3 *as that required under the conditions of mean temperature and duration of light during the same period at the respective stations.*

This conclusion may be tested by applying it to places where the growth of wheat has been attempted under unfavourable conditions. Thus, taking the case of Sitka, the accumulated temperatures actually experienced during the stated period (taking the mean of several years) is 830°, the mean temperature is 10·4°, the mean duration of light is 16·2 hours, and the index number of mean temperature plus mean darkness is therefore $10{\cdot}4 + (24 - 16{\cdot}2) = 18{\cdot}2$ With this index number the straight line in Fig. 3 indicates a required accumulated temperature of 770°. Consequently, the actually accumulated temperatures exceed this by 60°, and wheat cultivation is possible.

Similarly, at Copper Centre in Alaska the actual accumulated temperature is 780°, that required is calculated to be 760°, and the excess is therefore 20°. This very slight excess is in accordance with the fact that only two out of several specially selected varieties ripened.

In the north-west of Canada wheat has been successfully grown at the following stations, and the corresponding accumulated temperatures show that in these cases the rule holds. At the bottom of the list are placed the figures relating to two other stations where, although settlements have long been made and vegetables grown, no wheat has been raised.*

In 1905 seed was issued by the Canadian Department of Agriculture to a number of people in different parts of the Yukon Territory, and at Dawson, Pelly, and Minto wheat ripened. Meteorological observations were not made in connection with these experiments, but calculations based upon the mean temperature conditions for Dawson (lat. 62° N.) give

* The facts as to wheat cultivation are taken from the 'Report and Evidence of a Committee of the Senate on the Resources of the North-West of Canada,' 1907. Details of the calculations of accumulated temperatures are given in the table forming an appendix to this paper.

Station.	W. long.	N. lat.	Accumulated temperatures.		
			Actual.	Required.	Excess (+) or deficit (−).
	° ′	° ′			
Dunvegan	118 35	55 56	1091	964	+127
Fort Simpson	121 30	61 52	858	800	+ 58
Fort Vermilion	115 56	58 30	933	880	+ 53
Chippewyan	111 10	58 42	938	894	+ 44
Hay River	115 20	60 51	876	848	+ 28
Norway House	97 52	53 58	1101	1088	+ 13
York Factory	92 28	57 00	568	809	−241
Fort Churchill	94 11	58 51	464	745	−281

an actual accumulated temperature of 891°, a required accumulated temperature of 754°, and consequently an excess of 137°.

At Yakutsk in lat. 62° N. in Siberia, Vocikov states that spring wheat has been raised, and calculations based upon the *Climatological Atlas of the Russian Empire* show that the actual accumulated temperatures amount to 1118°, those required to 990°, and there is therefore an excess of 128°.

As the method holds good in all these cases, and in no case is there a conflict between this theory and the ascertained facts of cultivation, it has been applied to all the Dominion of Canada lying east of the Rocky Mountains where the meteorological data could be obtained. In the mountainous west of Canada the relief is so varied that it is impossible to construct a map showing actual temperature conditions with any accuracy, but from the cases cited above it is evident that wheat cultivation is possible in the coastal lowlands and river valleys of the west considerably beyond lat. 60° N. The meteorological data for the remaining portion of Canada have been obtained from three sources: (1) Statistics for stations in the North-West given in 1907 by the Director of the Dominion Meteorological Service as evidence to the Committee of the Senate on the Resources of the North-West, cited above; (2) the statistics in the *Monthly Weather Reports* of the Meteorological Service; (3) the monthly isotherms in the *Atlas of Canada* published by the Dominion Government in 1906.

It would seem desirable to use the statistics for the stations to which they relate, and for the regions between and beyond these stations to interpolate from the isotherms, but unfortunately the facts drawn from the isothermal maps do not agree with the statistics in some important respects. Thus the mean temperature for June at Moose Factory was given by the Director of the Meteorological Service in his evidence as 55·2° F., but in the isothermal map the position of Moose Factory is between the 45° and 50° F. isotherms and the reading would be approximately 47°, for no allowance need be made for altitude as the station is little above sea-level. Such a wide difference makes an error too great to be admitted. Again, the mean July temperature for Medicine Hat is stated in the evidence to be 68·1° F., and in the *Monthly Weather Review* for 1909 is given as 67·6° F.,

but in the map the station lies between the 60° and 65° isotherms, in such a position that a sea-level temperature of about 64·8° is indicated. Whether a further reduction for altitude is to be made is not clear. The statistics suggest that actual temperatures are shown, but this appears unlikely from the undeviating way in which the isotherms cross land of marked relief. Hence almost the only purpose for which the temperature maps in the *Atlas of Canada* have been utilized is to indicate the general trend of the isotherms for the summer as a whole, as the map of "Isotherms for Summer" in Plate 26 of the *Atlas* seems to agree better with the statistical returns.

The accumulated temperatures above 5° C. between the time in spring when the mean temperature curve rises to 5° C. and the time in autumn when it descends to 10° C. were then calculated from the statistical returns, and particulars regarding many of these are given in the appendix. The results were entered upon a map, and with the help given by the general trend of the summer isotherms, and occasional checking by the monthly isotherm maps, lines were drawn showing equal accumulated temperatures. In this work two difficulties presented themselves. Firstly, in regard to a few stations, *e.g.*, Beatrice, Father Point, and Bicquet, the statistics were not consonant with those of neighbouring stations, and had to be rejected. In these cases the temperatures recorded were lower than seemed possible from the position and altitude; this suggested that, if spirit thermometers were used, they may have been registering imperfectly, for the examination of instruments must be an extraordinarily difficult task for a Meteorological Service recording over so vast an area as the Dominion of Canada. Secondly, allowance had to be made for difference of relief. The accumulated temperatures were entered upon the relief map in Plates 2 and 3 in the *Atlas of Canada*, and the heights there indicated were supplemented by those given in the *Monthly Weather Review*. A reduction factor of 0·45° C. per 100 metres (1° Fahr. for 400 feet) was adopted for this region of central and eastern Canada on the authority of Hann's statement: * "Für die allgemeinen kontinentalen Landerhebungen dürfte wohl die Wärmeänderung mit der Höhe näher 0·4° als an 0·5° liegen," after allowing for the fact that here only summer temperatures are reduced, whereas Hann's statement refers to average annual conditions. To make the allowance for altitude, not only must the temperatures be reduced, but the periods of growth must be shortened; hence the calculation of accumulated temperatures had to be made anew for each significant increase of height. Only the larger features of the relief could be taken into account, and the map therefore does not show the smaller details of the distribution of temperature. It is to be regretted that the data do not allow the map to be extended over Newfoundland, but the conditions relating to the three stations in this colony of which particulars could be obtained are added in the appendix.

It is hoped that, although this map has been compiled with special reference to wheat, it may indicate the relative temperature conditions for

* Hann, *Handbuch der Klimatologie*, Band I. S. 214.

other forms of cultivation, *e.g.* that of other cereals, which do not differ widely from that of wheat.

It will be observed that the greatest accumulated temperatures, amounting in the south to about 2000° C., are experienced in the "Lake Peninsula" between Lakes Huron, Erie, and Ontario, and that these are prolonged to the north-east along the shores of Lake Ontario and down the St. Lawrence valley, beyond its junction with the Ottawa river.

Accumulated temperatures above 1500° C. are received in three regions: (1) The Red River valley and the southern portions of Alberta and Saskatchewan; (2) that part of the provinces of Ontario and Quebec lying south of a line drawn between Sault Ste. Marie and Quebec; (3) much of New Brunswick, Prince Edward Island, and the east of Nova Scotia.

These warmer regions are separated by the cooler uplands forming the eastern boundary of the St. Lawrence valley, and by the land around the northern shores of Lake Superior. Both because of its climate and also because of its soil, this latter district is in marked contrast with the productive areas lying to east and west of it.

North of the warmer areas of the east, the accumulated temperatures rapidly decrease, so that Ungava and Labrador offer little prospect of agricultural development, but the land around James Bay would seem to have somewhat better conditions, at least for the hardier cereals and vegetables. In the north-west there is a marked and very important extension of the moderate temperatures. The basin of the Mackenzie river-system is undoubtedly capable of very considerable development, for the latitude is such that the length of the summer days appreciably reinforces the moderately high temperatures. It must be borne in mind, however, that the settlements from which accounts of productivity are now received are situated in the lower grounds near the rivers; the uplands between the streams have lower temperatures, a fact to some extent brought out by the map.

In the penultimate column of the appendix are given the accumulated temperatures required for wheat in different parts of the Dominion; these vary from 800° C. at Fort Simpson, at the confluence of the Mackenzie and Liard rivers, where the mean temperatures are low and the days are long, to over 1400° C. at Welland in the Lake peninsula, where the mean temperatures are higher and the days are shorter. The excess or deficit of the accumulated temperatures experienced, as compared with those required for wheat, is given in the last column of the appendix, and entered in figures upon the map which shows the approximate limit of wheat cultivation as determined by temperature.

The line showing this limit is drawn through places where the accumulated temperatures experienced are just equal to those required. At Fort Simpson this line approximately follows the course of the 800° C. line of accumulated temperatures; in the neighbourhood of Hay River (at the southernmost point of Great Slave lake) the limit is where 850° C. are obtained; near Chippewyan (at the south-west of Lake Athabasca) 900° C.

are necessary; at Norway House the limit lies where the accumulated temperatures amount to about 1100° C.; and so at other places as indicated by the statistics in the appendix.

Calculations making allowance for the decrease of temperature for altitude show that along this margin of cultivation an additional elevation of 200 feet reduces by about 25° the excess of accumulated temperatures experienced over those required. Thus, as Fort Simpson has an excess of 58°, this excess would be reduced to nothing by an elevation of about 460 feet; hence, as the height of Fort Simpson is about 450 feet, the 900-feet contour line approximately coincides with the limit of wheat cultivation in this area, and only in the *valley* of the Mackenzie can wheat be grown. Similarly, at Fort Vermilion on the Peace river, at an altitude of 950 feet, there is an excess of about 53°; this would be negatived by a rise of about 420 feet, and therefore, in this part of the Peace river-basin, wheat cultivation is unlikely to be carried on at a greater altitude than 1400 feet. Similar calculations were made throughout the regions on the margin of cultivation to determine the limits as shown upon the map, and it would seem that within the general area of wheat cultivation in the north-west there are two considerable districts respectively east and west of the Athabasca river, where the elevation will not allow this form of agriculture.

If the limits here shown can be accepted, the Canadian territory between Manitoba and Lake Superior is too cold for wheat cultivation, and therefore separates the two great wheat-growing areas of the Dominion. If the control of temperature were alone considered, these two areas would appear not very unequal in extent, but other controls have to be taken into account, especially those of water and soil. The latter is very important in the eastern portion of the Dominion, for the glaciation of the region around Hudson Bay has left a large proportion of the surface in such a condition that wheat cultivation is either difficult or impossible. It is therefore probable that in this part of the Dominion the effective limit is set not by climatic but by soil conditions, and wheat will be grown only in the more favoured areas and for local consumption. Another factor which at present is of great importance in limiting agriculture is the natural vegetation-covering of the land; the clearing of the forests of the eastern lands is not undertaken while the open prairies of the west offer a more immediate return to labour, and it will therefore probably be long before cultivation extends to the limits set either by climate or soil in north-eastern Ontario and north-western Quebec.

Lack of meteorological data prevents the extension over Newfoundland of the line showing the limit of wheat cultivation, but the figures in the appendix together with facts regarding relief indicate that this cereal can be grown only in the south-eastern part of the island.

Two possible modifications of the above conclusion may be noticed. In the first place, the breeding of wheats requiring even less heat than those now employed in the cold regions will result in the limit being transferred

STATISTICAL APPENDIX.

TEMPERATURE AND LIGHT CONDITIONS IN CANADA.

Station.	Long. W.	Lat. N.	Altitude.	Date when curve of mean temperature exceeds 5° C.	Date when curve of mean temperature falls to 10° C.	Days in season.	Mean temp.	Total duration of light.	Mean daily duration of light.	Mean daily duration of darkness.	Index of mean temp. plus mean darkness.	Accumulated temperatures. Obtained in season.	Required for wheat.	Excess (+) or deficit (−).
	° ′	° ′	feet.				deg. C.	hours.	hours.	hours.		deg. C.	deg. C.	deg. C.
Fort Simpson	121 30	61 52	450	May 9	Aug. 30	113	12·6	2038	18·0	6·0	18·6	858	800	+ 58
Dunvegan	118 35	55 56	1300	April 23	Sept. 6	136	13·0	2210	16·3	7·7	20·7	1091	964	+ 127
Fort Vermilion	115 56	58 30	950	May 3	,, 3	123	12·6	2083	17·0	7·0	19·6	933	880	+ 53
Hay River	115 20	60 51	520	,, 15	,, 6	114	12·7	1992	17·5	6·5	19·2	876	848	+ 28
Calgary	114 2	51 2	3389	April 20	,, 16	149	12·6	2277	15·3	8·7	21·3	1129	1010	+ 119
Macleod	113 24	49 44	3128	,, 11	,, 25	167	13·6	2491	14·9	9·1	22·7	1444	1120	+ 324
Edmonton	113 20	53 30	2158	,, 15	,, 15	153	13·0	2386	15·6	8·4	21·4	1233	1018	+ 215
Chippewyan	111 10	58 42	700	May 6	,, 4	121	12·8	2051	17·0	7·0	19·8	938	894	+ 44
Medicine Hat	110 37	50 0	1759	April 7	Oct. 3	179	14·0	2651	14·8	9·2	23·2	1602	1160	+ 442
Battleford	108 20	52 41	1620	,, 22	Sept. 18	149	14·2	2304	15·5	8·5	22·7	1367	1120	+ 247
Swift Current	107 45	50 20	2439	,, 15	,, 24	162	14·6	2437	15·0	9·0	23·6	1548	1190	+ 358
Prince Albert	106 0	53 15	1432	,, 24	,, 12	141	13·3	2213	15·7	8·3	21·6	1166	1033	+ 133
Moose Jaw	105 35	50 21	1759	,, 23	,, 30	160	13·8	2393	15·0	9·0	22·8	1409	1127	+ 282
Qu'Appelle	103 47	50 30	2115	,, 23	,, 21	151	14·0	2290	15·2	8·8	22·8	1362	1127	+ 235
Cannington Manor ...	102 2	49 42	2064	,, 25	,, 19	147	14·3	2222	15·1	8·9	23·2	1363	1160	+ 203
Minnedosa	99 50	50 15	1699	,, 24	,, 22	151	13·9	2285	15·1	8·9	22·8	1348	1127	+ 221
Winnipeg	97 7	49 53	760	,, 21	,, 24	156	14·8	2342	15·0	9·0	23·8	1526	1205	+ 321
Norway House	97 52	53 58	700	May 4	,, 12	131	13·4	1981	15·1	8·9	22·3	1101	1088	+ 13
Fort Churchill	94 11	58 51	—	June 9	Aug. 26	78	11·0	1337	17·1	6·9	17·9	464	745	− 281
York Factory	92 28	57 0	—	,, 3	,, 30	88	11·4	1469	16·7	7·3	18·7	568	809	− 241
Port Arthur	89 12	48 27	644	May 1	Sept. 24	146	13·1	2175	14·9	9·1	22·2	1189	1080	+ 109
Fort Hope	87 48	51 32	950	,, 7	,, 12	127	13·1	1971	15·5	8·5	21·6	1032	1033	− 1
White River	85 16	48 35	1252	,, 3	,, 15	135	13·0	2036	15·1	8·9	21·9	1086	1056	+ 30

Bruce Mines	83 55	46 18	595	April 24	Oct. 6	166	14·5	2384	14·4	9·6	24·1	1585	1230	+ 355
Birnam	81 55	43 2	600	,, 9	,, 12	186	15·4	2609	14·0	10·0	25·4	1930	1330	+ 600
Moose Factory ...	80 50	51 15	—	May 14	Sept. 21	129	13·3	1973	15·3	8·7	22·0	1075	1064	+ 11
Haileybury	79 39	47 29	687	April 21	,, 28	160	14·2	2352	14·7	9·3	23·5	1474	1182	+ 292
Toronto	79 24	43 40	350	,, 9	Oct. 11	185	15·7	2606	14·1	9·9	25·6	1986	1347	+ 639
Welland	79 17	42 59	577	,, 9	,, 15	189	16·4	2642	13·9	10·1	26·5	2152	1417	+ 735
Abitibi	79 15	48 40	830	May 3	Sept. 18	138	14·0	2084	15·1	8·9	22·9	1238	1135	+ 103
Haliburton	78 28	45 1	1050	April 16	Oct. 5	172	14·8	2460	14·3	9·7	24·5	1678	1260	+ 418
Ottawa	75 42	45 26	294	,, 15	,, 7	175	16·1	2506	14·3	9·7	25·8	1945	1362	+ 583
Brome	72 36	45 10	678	,, 20	,, 3	166	15·0	2380	14·4	9·6	24·6	1653	1270	+ 383
Montreal	73 35	45 32	187	,, 16	,, 6	173	16·0	2498	14·4	9·6	25·6	1909	1347	+ 562
Quebec	71 13	46 48	296	,, 24	Sept. 30	159	14·8	2321	14·6	9·4	24·2	1554	1236	+ 318
Chicoutimi	71 5	48 25	150	,, 18	,, 23	158	13·9	2347	14·8	9·2	23·1	1409	1150	+ 259
C. Chatte	66 45	49 6	—	May 6	,, 20	137	12·7	2064	15·1	8·9	21·6	1058	1034	+ 24
Fredericton	66 22	45 57	39	April 27	,, 25	151	15·6	2210	14·6	9·4	25·0	1609	1300	+ 309
St. John	66 4	45 17	70	,, 20	Oct. 8	171	13·3	2444	14·3	9·7	23·0	1416	1143	+ 273
Yarmouth	66 2	43 50	65	,, 18	,, 9	174	12·8	2466	14·2	9·8	22·6	1354	1111	+ 243
Chatham	65 29	47 3	21	,, 24	,, 3	162	14·7	2359	14·6	9·4	24·1	1561	1230	+ 331
C. Magdalen	65 20	49 16	93	May 7	Sept. 22	138	12·6	2074	15·0	9·0	21·6	1055	1033	+ 22
Moncton	64 45	46 9	50	April 22	,, 30	161	14·2	2338	14·5	9·5	23·7	1479	1197	+ 282
Anticosti, West Point ...	64 32	49 52	30	May 14	,, 15	124	12·3	1890	15·3	8·7	21·0	905	987	− 82
Halifax	63 36	44 39	88	April 21	Oct. 12	174	14·3	2477	14·2	9·8	24·1	1618	1230	+ 388
Truro	63 18	45 22	—	,, 24	,, 3	162	14·1	2332	14·4	9·6	23·7	1473	1197	+ 276
Charlottetown	63 10	46 14	38	,, 26	,, 8	165	14·4	2378	14·4	9·6	24·0	1553	1221	+ 332
Anticosti, East Point ...	61 42	49 6	30	May 20	Sept. 16	119	11·8	1799	15·1	8·9	20·7	805	963	− 158
Sydney	60 10	46 10	35	,, 1	Oct. 8	161	13·8	2320	14·4	9·6	23·4	1421	1174	+ 247
Point Rich	57 25	50 42	35	May 25	Sept. 13	111	11·4	1705	15·4	8·6	20·0	710	910	− 200
Cape Norman	55 52	51 38	—	June 15	,, 9	86	10·1	1322	15·4	8·6	18·7	441	810	− 369
St. John's	52 42	47 34	125	April 21	,, 30	162	11·7	2374	14·7	9·3	21·0	1074	987	+ 87

to still colder areas, but to make any estimate regarding such developments is quite impracticable. In the second place, recent experiments by Sir Oliver Lodge and others show that by the application of electricity to growing crops the yield may be increased and maturity hastened. If this method results in any considerable shortening of the period necessary for growth, cultivation may extend beyond the limits here indicated, for the glaciated areas have abundant water-power whereby electricity may be cheaply obtained. Even in this case, the chief supply of wheat would be obtained in the more favoured west, and the areas near Hudson Bay would be relatively little utilized.

(*To be continued.*)

NOTE ON MEAN SEA-LEVEL.

By Colonel S. G. BURRARD, R.E., F.R.S., Surveyor-General of India.

In the *Geographical Journal* for December, 1911 (p. 605), the paper is published which Captain Henrici read at the British Association on the subject of "Mean Sea-level."

BOMBAY.

Year.	Mean sea-level above zero of gauge.	Yearly difference from general mean.	
	feet.	feet.	millimetres.
1878	10·265	+0·045	+13·7
1879	10·184	−0·036	−11·0
1880	10·187	−0·033	−10·1
1881	10·248	+0·028	+8·5
1882	10·194	−0·026	−7·9
1883	10·257	+0·037	+11·3
1884	10·256	+0·036	+11·0
1885	10·304	+0·084	+25·6
1886	10·267	+0·047	+14·3
1887	10·210	−0·010	−2·7
1888	10·249	+0·029	+8·8
1889	10·209	−0·011	−3·4
1890	10·230	+0·010	+2·7
1891	10·156	−0·064	−19·5
1892	10·285	+0·065	+19·8
1893	10·209	−0·011	−3·4
1894	10·237	+0·017	+5·2
1895	10·202	−0·018	−5·5
1896	10·233	+0·013	+4·0
1897	10·246	+0·026	+7·9
1898	10·332	+0·112	+34·2
1899	10·196	−0·024	−7·3
1900	10·176	−0·044	−13·4
1901	10·228	+0·008	+2·4
1902	10·310	+0·090	+27·5
1903	10·321	+0·101	+30·8
1904	10·191	−0·029	−8·8
1905	10·066	−0·154	−47·0
1906	10·141	−0·079	−24·1
1907	10·188	−0·032	−9·8
1908	10·142	−0·078	−23·8
1909	10·148	−0·072	−22·0
1910	10·204	−0·016	−4·9
General mean ...	10·220		

As there are questions concerning oscillations of sea-level now under consideration, it is of importance that all workers should have a correct idea of the magnitudes of the variations to which the mean sea-level of any one whole year is liable. Captain Henrici is mistaken when he says that the "mean height for one year at some Indian stations varies up to nearly 2 feet."

A self-registering tide gauge has been working continuously at Bombay since 1878.

The preceding table shows the height of mean sea-level as determined for each year from continuous series of observations. The last column indicates the amount by which each annual value of mean sea-level differs from the general mean of all.

It will be seen that in twenty-nine years out of thirty-two the difference from the general mean has been less than *one-tenth of a foot.*

The following table shows the mean annual variation and the greatest difference that has ever been obtained between two annual values of mean sea-level at thirty-five Indian tidal observatories:—

Tidal station.	Mean yearly variation of sea-level.	Greatest difference ever obtained between two annual values of sea-level.
	foot.	foot.
Suez	0·049	0·212
Perim	0·035	0·119
Aden	0·042	0·236
Muscat	0·019	0·065
Bushire	0·061	0·258
Karachi	0·057	0·280
Okha	0·026	0·052
Porbandar	0·035	0·070
Bhavnagar	0·069	0·192
Kathiawar	0·080	0·211
Bombay (Apollo Bandar) ...	0·044	0·266
Bombay (Prince's Dock) ...	0·077	0·405
Goa	0·044	0·126
Karwar	0·044	0·158
Beypore	0·027	0·111
Cochin	0·038	0·115
Tuticorin	0·044	0·113
Minicoy	0·033	0·095
Galle	0·041	0·130
Colombo	0·044	0·172
Trincomalee	0·066	0·217
Pamban	0·025	0·093
Negapatam	0·072	0·237
Madras	0·095	0·468
Cocanada	0·090	0·334
Vizagapatam	0·084	0·361
False Point	0·037	0·105
Saugor island	0·056	0·236
Bassein	0·104	0·207
Diamond harbour	0·070	0·207
Chittagong	0·106	0·328
Akyab	0·074	0·254
Diamond island	0·085	0·193
Mergui	0·041	0·182
Port Blair	0·067	0·358

The following four tidal stations are situated in the deltas of the Irrawady and Salween, and are consequently not suitable for scientific observations of the tides of the ocean. But even at these stations the annual variations of sea-level are small, and the maximum discordances ever observed are well under 1 foot.

Tidal station.	Mean yearly variation of mean sea-level.	Greatest difference ever observed between two annual values.
	foot.	foot.
Elephant point	0·16	0·67
Rangoon	0·10	0·52
Amherst	0·16	0·66
Moulmein	0·18	0·59

If relative changes in the level of land and sea are to be determined, the tidal observatory must be erected on an open coast to which the tides have free access. It would be useless for scientific purposes to erect a tidal observatory in a winding creek filled with moving sand-banks.

One of the tidal observatories of the Indian Survey is on the river Hooghly at Calcutta, but this is maintained for the use of the port authorities, who have to keep a watch on the river. The Hooghly was once a mouth of the Ganges, but is now moribund; it is this fact, according to Mr. J. R. Bell, which has enabled Calcutta to become a port. During the monsoon season the Hooghly still receives spill-water from the Ganges, more in some years than in others; perhaps even in the winter months Ganges water still percolates into the Hooghly. But the Hooghly can hardly now be regarded as a living mouth of the Ganges.

Calcutta is situated on the Hooghly, and is more than 80 miles from the sea; it is further from the sea than Birmingham or Oxford, and it is connected with the sea by a tortuous tidal creek in which sandbanks are always forming and moving. Engineering works (dredging, dams, reclamations) are constantly in progress in the vicinity of Calcutta, and the mean water-level at Calcutta is perennially 3 feet higher than the mean level of the open sea of the Bay of Bengal. Suffering from all these disadvantages, Calcutta might be expected to show abnormal variations in annual water-level, and it is surprising that it does not. From the following table it will be seen that in twenty-five years out of thirty the discrepancy of the annual value from the general mean has been less than half a foot.

From the results of the determinations of mean sea-level made at forty tidal observatories under the Survey of India, it may be safely concluded that if annual values of mean sea-level are found anywhere to differ by 2 feet, as mentioned by Captain Henrici, the discrepancy must

CALCUTTA.

Year.	Mean sea-level above zero of gauge.	Yearly difference from general mean.	
	feet.	foot.	millimetres.
1881–82	10·739	−0·026	−7·9
1882–83	10·686	−0·079	−24·1
1883–84	10·599	−0·166	−50·6
1884–85	10·669	−0·096	−29·3
1885–86	10·950	+0·185	+56·4
1886–87	11·383	+0·618	+188·5
1887–88	11·080	+0·315	+96·1
1888–89	10·842	+0·077	+23·5
1889–90	11·232	+0·467	+142·4
1890–91	11·364	+0·599	+182·7
1891–92	10·618	−0·147	−44·8
1892–93	10·817	+0·052	+15·9
1893	11·292	+0·527	+160·7
1894	11·383	+0·618	+188·5
1895	10·476	−0·289	−88·1
1896	10·123	−0·642	−195·8
1897	10·535	−0·230	−70·2
1898	10·858	+0·093	+28·4
1899	10·660	−0·105	−32·0
1900	10·604	−0·161	−49·1
1901	10·358	−0·407	−124·1
1902	10·398	−0·367	−111·9
1903	10·711	−0·054	−16·5
1904	10·830	+0·065	+19·8
1905	10·593	−0·172	−52·5
1906	10·722	−0·043	−13·1
1907	10·358	−0·407	−124·1
1908	10·397	−0·368	−112·2
1909	10·770	+0·005	+1·5
1910	10·895	+0·130	+39·7
General mean ...	10·765		

be attributed mainly to errors of observation. The probable error of a value of mean sea-level, as deducted from a complete year's tidal observations at a well-chosen coast station, should be about ±0·05 foot.

TEN YEARS OF ANTARCTIC EXPLORATION.*

By HUGH ROBERT MILL, D.Sc.

AT the moment when the attainment of the South Pole by the splendid journey of Captain Amundsen and his companions is bringing the congratulations of all the world to the fortunate explorer, it is useful to review the recent progress of discovery within the Antarctic Circle and consider whether the attainment of the Pole is likely to increase or diminish exploration.

In 1898 the new era of Antarctic exploration was initiated by the

* Map, p. 420.

drift of the *Belgica* in the pack throughout the first Antarctic winter ever experienced by man, and in 1899 the landing party from the *Southern Cross*, under Mr. Borchgrevink, lived through the first winter on the Antarctic continent. Neither expedition added much to the knowledge of the Antarctic region proper, which had been obtained more than half a century previously by Biscoe and Ross; but both prepared the way for a new method of attacking the old problem, and they effectually exorcised the demon of an unendurable winter climate in the far south. Borchgrevink's expedition also proved that the great Barrier in Ross sea had receded southward by about 30 miles since Ross had mapped it in 1841, and that it was not so uniformly inaccessible as was supposed, for at one point in 164° W. he had been able to land upon it, and found a smooth level surface over which travelling should prove very easy; Mr. Bernacchi, who was one of the party, suggested that a motor-car might be used upon it.

So far as the coasts of Antarctica were known up to this date they are represented in a light line on the accompanying map. The heavy lines on the map show the additions to our knowledge made in the last ten years, and these are sure to require extensive alterations when the result of the expeditions now in the field under Captain Scott, Dr. Mawson, and Lieut. Filchner become known to us. The blue tint shows open water so far as it is known or pack-ice through which some ship is known to have passed. The southern boundary of the blue in the places where it does not meet a coast is the track of the expedition which has got farthest to the south in that region. It is striking to find that the voyages of Cook (140 years ago), Bellingshausen (92 years ago), and Biscoe (80 years ago) are the latest which have attempted to approach the Pole or even the Antarctic Circle throughout great stretches of longitude. In fact, serious attempts to enter Antarctica have only been made in three places south respectively of New Zealand, South America, and Kerguelan.

The renewal of Antarctic research on a large scale in 1901–1904 by the associated expeditions of the *Discovery* under Captain Scott and the *Gauss* under Prof. E. von Drygalski, and the independent expeditions of Dr. Otto Nordenskjöld in the *Antarctic* and Dr. Bruce in the *Scotia*, produced an immense increase in our knowledge. This was followed up by Dr. Jean Charcot in the *Français* in 1904 and in the *Pourquoi Pas?* in 1909 in Bellingshausen sea on the one side of the continent and by Sir Ernest Shackleton in the *Nimrod* on the other side in 1909. It is remarkable that with the exception of the *Discovery* and the *Gauss* all these expeditions, like all those now in the field, were private enterprises organized by the explorers themselves and supported only to a very moderate extent, if at all, by public funds. While several of the expeditions made a prominent feature of the attainment of a high latitude, none of them could be classed as a mere dash to the pole, and all of them were

concerned in studying the physical conditions of the neighbourhoods in which they wintered, or which they were able to visit. It will clear the way for considering the results of the expeditions of 1911–12 if we trace, in a brief and general way, the main results and different methods of the expeditions between 1901 and 1909.

Looking first at the portion of the Antarctic continent which lies to the south of South America, and is approached from Bellingshausen sea on the Pacific side and from Weddell sea on the Atlantic side, we are impressed by the remarkably small addition to our information since the voyage of the *Belgica*. Nordenskjöld's expedition failed to cross the Antarctic Circle; but Bruce, in the *Scotia*, made a fine run to the southward midway between the routes of Weddell and Ross. He found deep water, which made it certain that there is no continental land in the great unknown segment from 62° to 72° S. between the meridians of 15° and 30° W. At the extreme south he found shallow water and sighted a coast (Coats Land) in 74° S., the most southerly land known in the Antarctic regions except the shores of Ross sea, diametrically opposite to it. We are still quite ignorant of the great slice of Weddell sea between 35° and 60° W., in which Dr. Bruce believes that the New South Greenland of Morrell is concealed. If this be so, Morrell must have been at least 3° out in his latitude, for in 1823 he says he coasted it to the north point of New South Greenland, in 62° 41′ S., and no shipmaster could have made so serious a mistake. If we can believe Morrell at all, it is easier to suppose that he made a mistake of 10° in his longitude, a very easy thing in his time, and that the land he coasted was the peninsula terminating in Louis Philippe Land. By this time Lieut. Filchner may have solved the problem.

In Bellingshausen sea Dr. Charcot has greatly extended our knowledge. He has traced the coast of Graham Land to 73° S., giving to the southern parts the names of Loubet and Fallières. He shows that Gerlache's position for Alexander I. Land corresponds roughly with his Loubet Land, while he finds Alexander I. Land to occupy almost exactly the position originally assigned to it by Bellingshausen, and that it is apparently an island, Fallière's Land seeming to extend behind it. Charcot Land and another new land not fully surveyed carry on the line of land to 70° S. and 80° W. Charcot's last definite advance was to sail west south of 70° S., and to emerge from the Antarctic Circle in about 125° W., thus cutting a substantial slice from the hitherto untouched region of the ice-pack.

These investigations on the American side have all been by sea, and they have been subject to all the uncertainties and baffling difficulties of ice navigation and the frequent necessity of fixing positions by dead reckoning in foggy weather. South of the Atlantic and Indian oceans the only advance since the time of Biscoe has been the discovery of Kaiser Wilhelm Land by the *Gauss* just on the Circle, and no notable land

journeys were made in that region. But we know that two landing parties of Dr. Mawson's Australian expedition are there just now. South of the Pacific from Charcot's farthest in 124° W. to the meridian of 150° W. at King Edward Land, no ship has tried to get south of the tracks of Cook and Bellingshausen, and Cook, in 1773, was the last man to reach the Antarctic Circle in those seas.

There remains only the area of Ross sea between the meridians of 150° E. and 150° W., one-sixth of the circumference of the Antarctic Circle, but within that sixth there have been crowded in the last ten years the labours of four separate and successive expeditions, exploring by land in many directions—those of Captain Scott in the *Discovery*, of Sir Edward Shackleton, of Captain Amundsen, and of Captain Scott in the *Terra Nova*, of whose achievements we have not heard up to the time of writing.

The *Discovery* expedition was confronted by the serious problem of organizing land exploration on the Antarctic continent for the first time, and this was complicated by the still unbroken traditions of Arctic sledge travel—always follow a coast-line, never establish a base camp on floating ice, and the rest. The expedition was designed for scientific research into magnetism, geology, biology, meteorology, and other subjects; but Captain Scott carried out two long journeys of epoch-making importance in conditions of great difficulty due to improper food, for which he was in no way responsible, and the consequent weakening of the dogs. In his southward journey he kept along the Barrier ice from MacMurdo sound under the great range of coast mountains, which he followed to 82° 17′, 380 miles from his base, much embarrassed as he approached the mountains by crevasses and disturbed ice. Far to the south great summits could be seen, indicating a continuation of the range. In a second great journey in the following year a way was found through the mountain range and over the high plateau behind, above 9000 feet in altitude, due west to 146° 33′ E., a distance of 300 miles from the ship. The results of this expedition were enormous. The expedition had spent two winters 500 miles nearer the south pole than people had ever wintered before, the method of laying out depôts for food in advance on the sledge routes had been worked out, and an immense advance in geographical knowledge secured. It was shown that Ross's Great Barrier was not the end of the ice-cap, but the edge of a vast expanse of level ice probably afloat, fixed on the seaward side between Ross island and King Edward Land, with a front of 490 miles, and extending southward more than 380 miles. On its western edge this level ice was shown to be ridged and crevassed where it met the base of a great mountain range running from Cape Adare in 71° S. to at least 83° S., a distance of about 850 miles; and this range buttressed a vast plateau rising to more than 9000 feet above sea-level, and as uniform and level on the summit as the surface of the barrier at the base.

Sir Ernest Shackleton started in 1907 with the design of establishing himself at King Edward Land and making a journey southward towards the Pole over the surface of the Barrier, though his expedition was also equipped for very extensive scientific work. Compelled to relinquish his original design, he wintered in MacMurdo sound, and advanced geography in three different directions. One party made the first ascent of Mount Erebus; another under Prof. David reached the South Magnetic Pole, and proved that the high plateau extended along nearly the whole length of the great coast range towards the north. The third party, trusting to Siberian ponies instead of dogs for transport, travelled south over the Barrier surface, keeping about 50 miles farther from the mountains than Scott had done, and so finding smoother and less broken ice. In 84° S. the Beardmore glacier was found, offering a practicable though difficult path to the plateau behind the mountains, and over the smooth surface of that plateau, at an elevation approaching 10,000 feet, Shackleton and his companions struggled on to 88° 23′ S., where starvation, due to the loss of all the transport animals, compelled them to return. But for the loss of the last pony the Pole would have been reached. The farthest point reached was 420 miles beyond Scott's farthest, but still 113 miles from the Pole. The great mountain range was traced to 86° on the plateau side, and it was trending strongly to the south-east, suggesting that it might turn and run towards Edward VII. Land. The length of the mountain chain from Cape Adare was extended to 1060 miles, and the height of the loftiest summits seemed to be increasing towards the south-east.

The southern summer 1911–12 saw even more expeditions in the southern ice than on the great revival in Antarctic exploration ten years earlier. Lieut. Filchner was entering the Weddell sea. Captain Scott has been working from MacMurdo sound, and a part of his expedition from Cape Adare; Captain Amundsen from a point on the Barrier near King Edward Land, where a Japanese expedition arrived as he left; and Dr. Mawson had landed two parties on the part of the continent known as Wilkes Land; where, according to a Reuter's telegram from Hobart, he had shown that D'Urville's Côte Clarie does not exist as land. We may expect to find great changes on the map in this quarter, but what they will be remains to be learned when news comes of last season's work from Captain Scott and of next season's work from Dr. Mawson.

The report of Captain Amundsen's expedition, as given in the *Daily Chronicle* of March 9 and later issues, is singularly full, clear, and satisfactory. It enables one to plot the route and grasp the salient features of the expedition with a fair degree of certainty. Amundsen and his fellow-countrymen are, of course, expert ski-runners, and some of them are extremely skilled dog-drivers. They had a great fund of personal experience both in the Antarctic and the Arctic regions to draw on, and they had the records of the two previous expeditions on the Barrier ice

to serve as guides and warnings. As a result of this they relied mainly on frozen seal-meat, of which they collected a great amount along the Barrier front and laid out very large depôts in the autumn after their arrival, so that when they started in the following spring there was no need to economize food. The Barrier surface afforded very easy going, and the party travelling southward over it covered an average distance of 20 miles per day. They followed the 164th meridian of west longitude, and struck the mountain range of Victoria Land in about 85° S., about 200 miles south-east of the Beardmore glacier. Here a path to the plateau was found by following the Devil's glacier, which led between summits of from 12,000 to 15,000 feet high, and at its upper end it led out on to a plateau, the highest point of which was 10,750 feet near the 88th parallel, sloping down to 10,500 feet at the Pole, which was reached easily on December 16, 1911, and a series of hourly altitudes of the sun taken by several observers simultaneously for twenty-four hours. The accuracy of the determination is thus placed beyond all doubt. The return journey to the ship presented no difficulties, and all the men, with eleven dogs, returned in perfect health on January 25, 1912. The important results of this expedition, apart from the sentimental value attached to reaching the Pole, are, first, the rapid travelling and total absence of illness or accident on a double journey of 1700 miles. Second, the discovery that the Great Barrier terminates in a bight apparently encircled by the mountain chain in about 80° S. and 160° W. There seems to be no doubt that the coast range is continuous from Cape Adare to this point, 1300 miles, with the level white surface of the plateau above all the way, and the level white surface of the Barrier ice at its feet for the last 600 miles. The range, it would appear, then divides (but on this point we cannot yet be sure), one branch continuing towards the south-east pointing towards Graham Land, the other turning north-east towards King Edward Land. The latter probably curves widely to the eastward, as there is no mention made of land having been seen in that direction from the route across the Barrier ice, although to the west the mountains of Victoria Land had been visible for more than 100 miles. The description of Amundsen's discoveries fits in in the most satisfactory way with those of Scott on the *Discovery* expedition, and of Shackleton. While Amundsen was in the south, a party of three made a journey to King Edward Land, confirming the accuracy of the coast-line as shown in Captain Scott's map; but the details concerning this part of the work are not full enough to enable us to judge how much new information was obtained.

It now becomes a question whether the exploration of these regions should be continued from the same centre, or renewed in the less-known portions of the circumference of the Antarctic Circle. There is evidently a very tempting opening for a fine expedition along the east side of the Barrier ice to trace the land connection between King Edward

Land and the southern range, if such a connection exists, or to trace the Barrier ice through to the sea behind King Edward Land, if that land is insular. And, apart from this, there is the following of the south-eastern range to its termination to be undertaken; and after that, the crossing of the great plateau beyond the Pole to whatever end it may lead. We have no doubt that great inland journeys have been carried out by Captain Scott's parties, and that such will be carried out by Dr. Mawson's; but even when the results of these are known, we cannot let Antarctic exploration lapse until the continent is bounded by a firm coast-line, or, as now seems much less likely than it did, is split into an archipelago of great islands. The fact that the South Pole has been reached has a certain value, and perhaps the best result of the attainment both of the South Pole and the North is that there is no farther occasion for sensational "dashes" and acrimonious discussions between rival claimants. The fact that both poles have been reached with less difficulty than has accompanied earlier explorations will no doubt dispel much of the terror of the possibilities of polar climate, and by attracting explorers of a more scientific, though perhaps of a less adventurous, disposition will enable a sufficient knowledge of polar geography to be obtained in a few years for all the important purposes to which such knowledge can be put.

CAPTAIN ROALD AMUNDSEN.

At the meeting of the Society on March 11, Major Leonard Darwin, Vice-President, who was in the chair, made the following remarks: Since our last meeting we have all heard that that courageous Norwegian explorer, Amundsen, who is known to many of us here present, having lectured before this Society, and who has done such excellent work in the Arctic regions, has succeeded in his endeavour to reach the South Pole. On this occasion I do not think I need do more than read the telegram which, at the request of the Council of your Society, your President, Lord Curzon, has to-day sent to him in Tasmania. The telegram runs as follows: "On behalf of Council Royal Geographical Society I congratulate you upon your magnificent journey and successful attainment of the South Pole. (Signed) Curzon, President." I can tell by the applause that all here present endorse the action of the Council in sending this telegram.

NOTES ON NGAMILAND.

By A. G. STIGAND.*

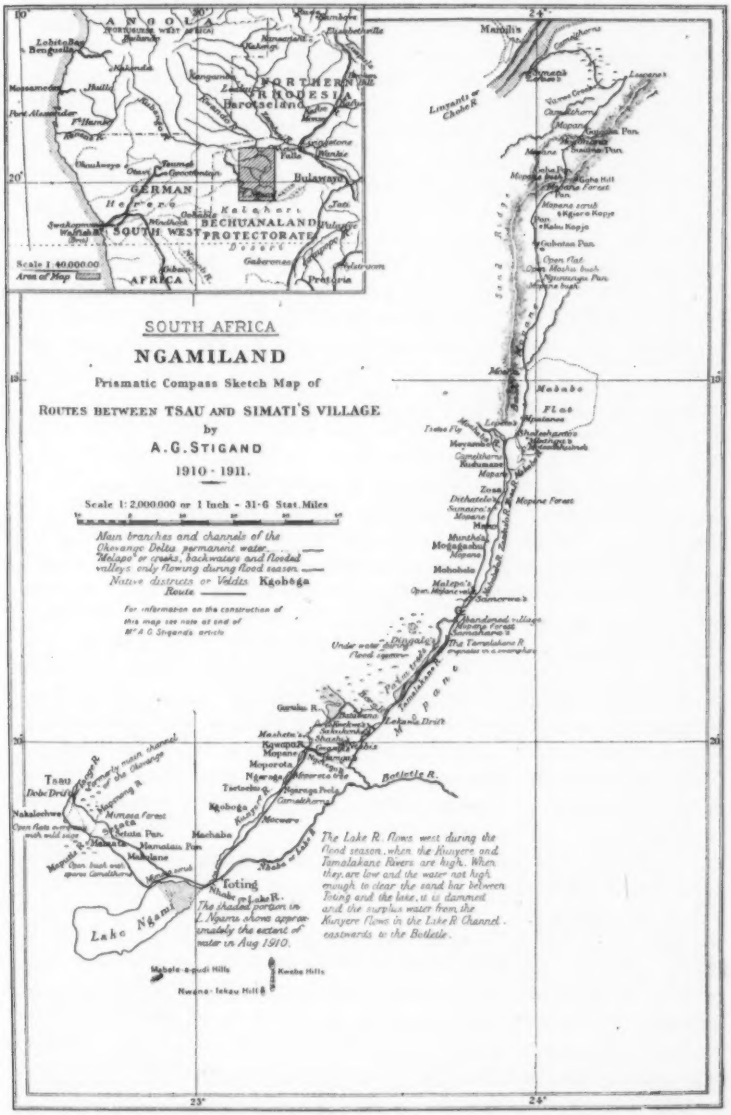
NGAMILAND is the north-western district of the Bechuanaland Protectorate, and of this about three-quarters, *i.e.* the northernmost portion, including Lake Ngami, are occupied by the Batawana reserve. The Okovango river (or more properly, the Kovango) enters the reserve towards its north-west corner. Mr. Stigand's description of this river system agrees in the main with those of Passarge, and of Mr. R. Williams, whose reports on the subject were referred to in the *Journal*, vol. 30, p. 440. It enters the reserve in one strong stream (which during the winter season averages 650 yards broad by 16 feet deep), and begins to overflow its banks in about 18° 21′ S., spreading out fanwise at about 18° 50′ S. into many channels and swamps, which attain a width of some 100 miles just before 20° S. Most of the main branches are perennial, flowing in fairly deep beds, but a large part of the swamps and many of the creeks are quite dry except during the winter flood. The perennial channels are known to the Batawana as "noka" (river) in contradistinction to "molapo," an intermittent creek or backwater. Most of the water goes down the easternmost rivers; the most westerly, still considered the main branch of the Taukhe or Taoge, now ending in a swamp some 13 miles short of the Ngami basin. Before 1850 a much larger volume of water came down this river, and the Okovango itself seems then to have been much more copious. Native report indicates that the Taukhe ceased running into Ngami about the end of the seventies of last century. At present water reaches the lake-bed only when the eastern branches, the Kunyere and Tamalakane, are in high flood; the whole of the former and a part of the latter then entering the basin, though the larger portion of the Tamalakane still flows east down the Botletli.

Ngamiland may be broadly divided into two zones, that of the rivers, in which tropical vegetation (palms, etc.) predominates, and the sand-belt, with the sub-tropical vegetation (thorny acacias, etc.) of the Kalahari. In the latter zone, north of the 20th parallel, the *Copaifera mopane* predominates, and between Ngami and the Linyanti river practically excludes other vegetation.

The Batawana of this region are an offshoot of the Bamangwato, the branch of the Bechuana ruled by Khama. In about 1800 the chief Tawana ("Little Lion") quarrelled with his brother, and pushed north,

* Mr. Stigand, whose knowledge of the Sechuana languages has given him special facilities for inquiry among the natives, has sent us a general account of Ngamiland and its inhabitants, accompanied by a set of photographs and by a compass sketch-map of two journeys between Tsau and the Chobe or Linyanti river, which we here reproduce. The following notes are condensed from the original paper, which is too long for publication *in extenso*, but which will be placed for reference in the Library.

establishing himself and his followers near Lake Ngami, in the country



of the Makuba, Makhalahadi, and Masarwa (Bushmen). The Makuba are of fine physique and are expert at punting in shallow water, but, unlike

their northern neighbours the Mambukushu, are helpless with the paddle. According to the accounts of an old Mokuba, whose grandfather was chief when Tawana and his people arrived, the tribe was then much more numerous. The lake was then a sheet of open water, in which canoes were often lost. Tawana was friendly with the Makuba, being anxious for them to teach his people canoeing, and it was under later chiefs that they were made subject. The river system abounds in fish, especially perch, some thirteen varieties of which were obtained by Mr. R. B. Woosnam during his recent zoological expedition on behalf of the British Museum. There is also a small kind of pike; the usual barbel-like mud-fish of South Africa ("toni" of the Makuba); and, in the Okovango, the "tiger-fish," a large black-and-white fish of pike habits. The Makuba fish chiefly with the net, which they manufacture from the fibre of an aloe; but they also use fish-traps, both fixed and portable. Their usual dress consists of a strip of leather about the middle, having a quaint ornament behind formed of a pair of wings about 6 inches in diameter. They also make themselves leather jackets, mostly sleeveless, and hats of grass. A fair percentage now profess Christianity, their own religion consisting merely in the belief in a Supreme Being.

The Batawana are all Christians, and wear European clothes. Up to the middle of the 'eighties they lived at the eastern end of the lake, at the spot now called Toteng or Toting—a contraction of Matoteng (or properly Matotleng in Sechuana), the locative case of Matlotla, "abandoned huts." After the second raid of the Matabele in 1886 (when they took refuge with their cattle on an island in the swamps) they moved their village, under their chief Moremi, to Nokaneng on the Okovango, and have since moved several times, finally settling at Tsau,* where they dwell to-day under their progressive young chief Mathiba. They reside at Tsau except when visiting their cattle posts and fields, or when out hunting. The women mostly spend the summer half-year at the cornfields, where there are huts and little villages. The young men have degenerated both in character and stamina, chiefly through lack of parental discipline and their inactive and unmanly life.

Referring to the nomadic Mosarwa, or Bushman, Mr. Stigand describes, in fuller detail than has been done by other travellers, the process by which he makes the poison for his arrows. The account is too long to be given here, but it may be stated that the chief ingredients are the dried and powdered grubs obtained from beneath the low thorn-bush called "doru," and the sap of the "mongana" (*Ziziphus mucronata*, or "wait-a-bit" thorn). Only one individual was found among the Batawana who possessed a knowledge of the process of preparation. Besides the ordinary sandbelt Masarwa, there is another group, darker in colour,

* This word properly begins with the linguo-dental click, and in the Bushman language means "many buffaloes."

who dwell in fixed villages on the rivers and live chiefly by fishing. They are naturally much inferior to their kindred of the sandbelt as hunters.

Of Mr. Stigand's two journeys from Tsau to the Linyanti river, the first was made in July–August, 1910—as far as Toteng with cart and oxen, by the circuitous southern road to avoid flood water; and from Toteng onwards by boat. On emerging from the Moshu and Muka scrub into the sandy flat bordering Ngami, nothing was to be seen but a sea of reeds, with the Mabele-a-pudi and Kwebe hills beyond. No further hills were seen until beyond Mababe. On the return journey there was a good flow of water from the Kunyere and Tamalakane into the lake—more, in the natives' opinion, than had been the case for several years. Mr. Stigand pushed on by canoe into the reed-beds, but the water grew more and more shallow until its limit was almost reached. He was told by old Makuba that when the water retreated from the western end stumps of sandbelt trees were exposed, showing that woodland had once existed there. The second journey was performed with cart and oxen the whole way, only the Tamalakane river being then unfordable, and the cart was floated across this. Notes as to the game seen complete the paper.

NOTE.

Mr. Stigand's map is based upon a prismatic compass-traverse from Tsau to Simati's village, made during February and March, 1911, and a previous compass-traverse by boat in July and August, 1910, between Toteng and Mababe, which was corrected later by the 1911 land-traverse. No astronomical observations were taken, and the map has been adjusted to the position of Mamili as given on F. Seiner's map (*Mitteilungen aus den Deutschen Schutzgebieten*, Band xxii., 1909), and to Dr. S. Passarge's position of Toteng taken from the map in his book 'Die Kalahari.' This adjustment has only made it necessary to decrease the total distance between these two positions by 3 miles, or by about 1 per cent. of the distance as given by Mr Stigand's plotted traverse, while the general bearings remain about the same.

On the 1911 land-traverse distances were measured by a trocheameter attached to a cart wheel, allowance of 60 yards per mile being made by Mr. Stigand for irregularities and windings of the route. The compass bearings were taken at intervals of about five minutes.

MRS. SCHÄFFER'S DISCOVERY AND SURVEY OF LAKE MALIGNE, CANADIAN ROCKIES.

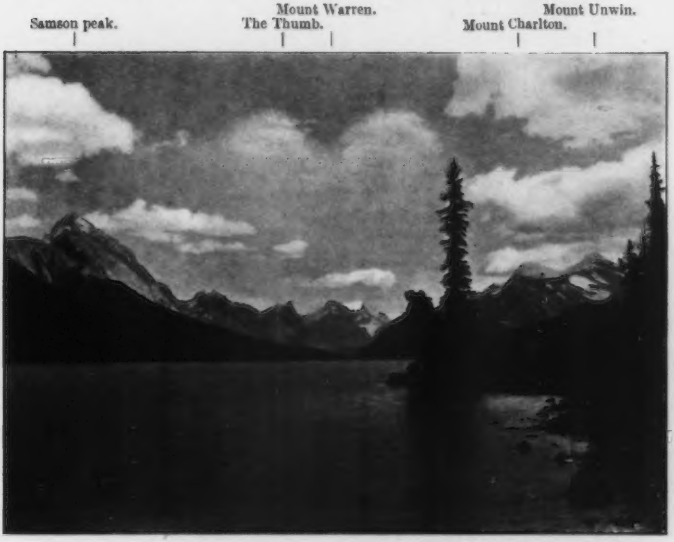
The accompanying map and photographs have been sent us by Mrs. Mary Schäffer, who, as she has recorded in her recently published book, 'Old Indian Trails,' in 1908 discovered a hitherto unknown lake in the Canadian Rockies, of considerable size and remarkable beauty, to which she has given the name Maligne, long applied to the tributary of the upper Athabasca by which the new lake is drained, through the smaller Medicine lake. The first report of the Maligne lake had been

obtained from a famous hunter and guide, James Simpson, who himself had the information from some friendly Stoney Indians, who used the neighbourhood as a hunting-ground. A first attempt to reach the lake, in 1907, proved unsuccessful, Mrs. Schäffer's party being stopped by a late August snowstorm when trying to force a way over the mountains to the north of Brazeau lake. They, however, met a Stoney Indian, who gave information as to the best method of reaching the lake. Returning to the search in 1908, with the guides W. Warren and S. Unwin of

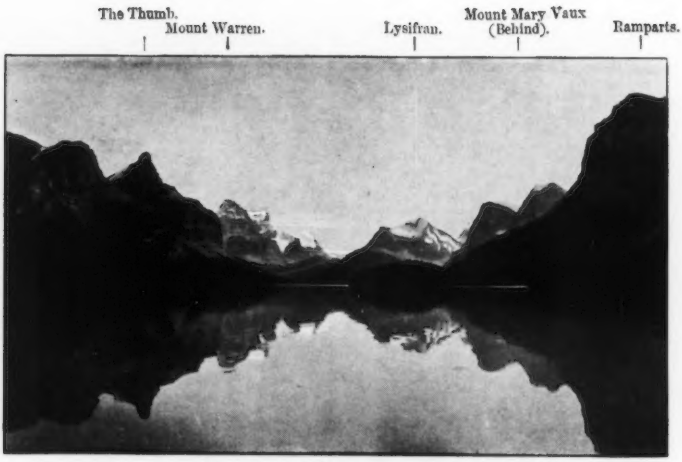
Banff, Mrs. Schäffer followed a route used by Prof. Coleman in 1898 from Brazeau lake to Pobokton pass, and, after following the Pobokton creek for some distance, struck off to the right by an Indian trail, which in three weeks brought the party to the object of their quest. On this occasion the lake was only partly navigated, in an improvised raft, but enough was seen to convince the traveller that the lake had not its equal on the eastern slopes of the Canadian Rockies.

On mentioning her find to Mr. D. B. Dowling, of the Canadian

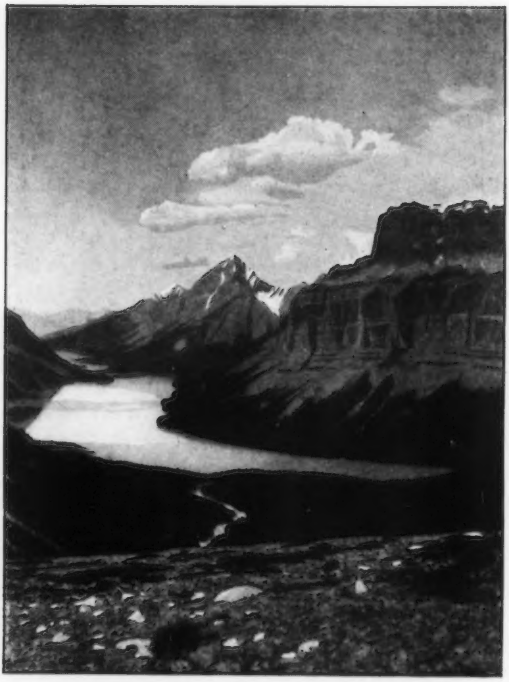
LOOKING NORTH-WEST AT MOUNT CHARLTON FROM PIXIE VALLEY.



VIEW TAKEN NEAR LAKE'S OUTLET.
(B. Harmon, Banff, photo.)



FROM THE UPPER END OF THE NARROWS.
(B. Harmon, Banff, photo.)



SAMSON PEAK. PART OF LAKE FROM 7000 FEET.

Survey Department, the latter urged her to return and make a survey of the lake; and, having instructed her in the method to be adopted, and provided the requisite appliances, prevailed upon her to make the attempt. The Canadian National Park Commissioner also assisted by having a trail of 35 miles cut through the wilderness and supplying the material for making a boat. This was built at the mouth of the lake, and was of material assistance in shifting camp from one spot to another, as well as in the actual survey. This was begun at the mouth of the lake, the entire circuit of which was made twice over, compass readings being taken from each prominent point to the next, and the distances obtained by reading the log. At each station three readings of the compass were taken and an average adopted. The actual form of the shores was constantly sketched in as the work proceeded.

The names inserted on the map have been accepted by the Geographical Board of Canada. The lake is about 18 miles long, and it is reached by a pass of considerable altitude, two readings of the aneroid giving 8000 and 8300 feet. Among the flowers found on the pass, some were growing in profusion that are elsewhere great rarities. The lower end of the lake is bordered by hills of moderate height, but they rapidly increase in height to the south-east. Samson peak will make an interesting climb for one seeking rock work, while Unwin and Charlton on the opposite side must be from 10,000 to 11,000 feet high, judging from the snow conditions. Beyond them rise others of equal elevation, and glaciers, waterfalls, and open stretches of meadow (giving pasturage to large numbers of mountain goats) add to the beauties of the scene. Many varieties of ducks nest in the neighbourhood during June and July, and many were still there when the party left in August. No fish are found in the lake, which may be accounted for by the nature of the lake's drainage. The outlet cuts its way to the Athabasca through a gorge 50 to 300 feet deep, and the view from the trail which was cut along its brink showed that a vast quantity of water forced itself out from between the strata in which the gorge is cut. In fact, nearly the whole of the water from Lake Maligne runs through subterranean passages after reaching Medicine lake, which on this account is almost empty when the snow-fields are frost-locked in winter. It occupies a rock-basin about 2 miles long.

GILCHRIST STUDENTSHIP IN GEOGRAPHY.

1. The Gilchrist Trustees have resolved to grant an Annual Studentship in Geography, of the value of £100, for advanced work in the subject, but not for preliminary training.

2. The studentship shall be confined to teachers of either sex who have had experience in teaching geography, and who possess an adequate knowledge of it.

3. The student shall pursue a definite course of geographical study to be approved by the Trustees.

4. Applications for the Studentship, accompanied by the documents noted below, should be sent to the Hon. Secretary, Geographical Association, 40, Broad Street, Oxford, not later than April 25 in each year.

5. The applications should include a statement of the age and career of the applicant, the training in geography, the experience in teaching it, and the name of the Head Master or Mistress, or Governor of a School, or others to whom reference can be made. The application should also state what work the candidate would propose to do if elected, and what time would be devoted to it. These applications will be considered by a Joint Committee, consisting of two members elected by the Council of the Royal Geographical Society, two by the Committee of the Geographical Association, and either one or two by the Trustees, who will submit recommendations to the Trustees.

6. The amount of the Studentship shall be paid in such instalments and at such times as the Committee shall decide. In general, nine months shall be devoted to the work of the Studentship.

7. It will usually be advisable for the student to place himself under the guidance of some university teacher in geography approved by the Trustees during the tenure of the Studentship.

8. A report on the work done as Gilchrist student must be submitted to the Committee. If this is held worthy of publication the Trustees will be prepared to contribute a sum of not more than £10 towards the expenses thereof.

9. The student shall sign a declaration that he or she intends to continue to be a teacher of geography for not less than two years after the expiry of the Studentship.

10. The Trustees will be glad if the Head Master, Head Mistress, or the Governors of, or the Public Authority responsible for, the candidate's school, will guarantee that the candidate's post shall be kept open during the tenure of the Studentship, or that at the expiry of the Studentship a post shall be offered to the candidate at least equal in value to that which the candidate would have held had the Studentship not been awarded to him or her.

11. The student shall not undertake any other work during the tenure of the Studentship, unless the consent of the Trustees has been previously obtained in writing.

REVIEWS.

EUROPE.

'Guides Flammarion.' (Paris: Flammarion. [*N.d.*] *Maps and Illustrations.* 2 *fr.* 50*c.* each volume.) There are eight volumes before us of this new series of French guides; two deal with Normandy, the others with Auvergne,

Languedoc, and Roussillon, the Côte d'Argent, the Ardennes and the Vosges, Brittany, and the French Alps. They are volumes of convenient size, running to some two hundred pages each, and are clearly printed though roughly mapped and illustrated. The maps, in fact, are the least satisfactory feature, as they are hardly sufficient in themselves to enable the traveller to find his way. The information appears to be such as should be expected, though not of that detailed character to which familiar series of guides have accustomed us. The brief introductions to the volumes are not without geographical interest.

'Handbook for Spain.' By A. F. Calvert. (London: Cook. 1912. Pp. xii., 264. *Maps and Illustrations.* 7*s.* 6*d. net.*) Mr. Calvert's name is sufficient guarantee for the value of any work on Spain, and the publishers have been fortunate in the authorship of this guide, which appears to contain all necessary information for travellers, and at the same time to be far more readable than most guide books. It is not very well mapped, and some of the town plans have been reduced too small to be easily legible.

'Spain Revisited.' By C. Gascoigne Hartly (London: Stanley Paul. 1911. Pp. 330. *Illustrations.* 12*s.* 6*d.*) This book deals mostly with Galicia. It is a mixture of description and historical notes, not perhaps on very original lines, but informative, and illustrated by some excellent photographs. It is always a pleasure to meet with enthusiasm in travel. Possibly not all will share the views of the authoress as to travel and residence in Spain.

ASIA.

Kashmir and its Mountains.

Beyond the Pir Panjal: Life among the Mountains and Valleys of Kashmir.' By Ernest F. Neve, M.D. London: T. Fisher Unwin. 1912. Pp. xvi., 320. *Illustrations and Sketch-maps.* 12*s.* 6*d. net.*

Dr. Neve's object through three-fourths of his book was "to combine and set forth in compact form the great variety of interests in Kashmir, and the chief characteristics of the central and outlying valleys with their widely distributed population." He starts with an account of the Pir Panjal range, and the first ascent of Tatticooti. We next follow the course of the Jhelum to Baramula and get a general description of the Vale of Kashmir, with a good deal of miscellaneous matter, historical, legendary, commercial, etc., thrown in, somewhat in guide-book fashion, on the way. Srinagar is reserved for later treatment. The scene shifts to Mount Haramok, which Dr. Neve conquered in 1899 after several earlier attacks. Then follow two interesting chapters on "Village Life" and "The People" (oddly separated by a perfunctory digression on "Historical Epochs"), and another, also good, on "Wild Flowers," after which we are conducted over a high-level route from Sonamarg to Gangabal Lake; through the Lolab; down the Wardwan valley to Kishtiwar; to the Cave of Amarnath; and, lastly, to the snows and glaciers of Kolahoi, where some valuable pioneer work was accomplished. After a graphic chapter on Medical Mission Camp Work and the Great Flood, we leave the vale for a prolonged tour to Leh and Hemis (where a performance of the demon dance was witnessed), and down the Indus to Baltistan. We get here some good bits of description, and a large amount of provokingly fragmentary history; also a sketch, very slight, of the Mustagh range and its exploration in recent years, eked out by lengthy extracts from Sir F. Younghusband's narrative of his passage of the Mustagh pass in 1887. The author then hurries back to the vale by the Deosai plateau and the Gilgit road, and winds up with a description

of Srinagar and its environs. The book so far, regarded as a general account of Kashmir, is of very unequal merit. Little thought seems to have been given to its arrangement; indeed, the order of the chapters is bewildering, and one is left with the impression that a good deal of pre-existing material has been thrown together without much effort to transform it into a harmonious whole. Dr. Neve is at his best when he is most personal and most detailed, and brings into full play his familiarity with Kashmir under all variations of season and climate, and his extensive knowledge of its flora. One would gladly have heard more about Kashmir in winter. The subject of sport is scarcely touched upon. A map is badly wanted; the one supplied is totally inadequate.

The rest of the book, dealing with the Kashmir Mission School, run on highly original lines by Mr. Tyndale-Biscoe, and the history and work of the Medical Mission is on altogether a different plane of interest. Dr. Neve has things to say about which he is intensely in earnest, and he says them well. The medical work is described with sober but infectious enthusiasm, and there are some delightful narratives of individual cases at the hospital. But Dr. Neve's deepest interest does not lie in his medical duties. Aware that among his supporters there are many "who do not believe in what they call 'the missionary part of our work,'" he presents his own views in singularly persuasive fashion, and some of his observations are of exceptional interest in view of the prevailing "unrest." While every reader of the book may not be convinced that all medical men working among natives should be missionaries, all will certainly agree in wishing that every missionary might be a medical man of the stamp of Dr. Neve. A. L. M.

Caucasia and Persia.

'From Constantinople to the Home of Omar Khayyam.' By Prof. A. V. Williams Jackson. New York: The Macmillan Company. 1911. 15*s. net.*

Prof. Williams Jackson is already well known in England for his work on 'Zoroaster' and his 'Persia, Past and Present,' which latter deals with Western Persia. In the book under review he starts from Constantinople and travels to Baku. From this centre he makes an excursion to Derbent, the famous "Gate of Gates" which bars the way between the Caucasus ranges and the Caspian sea. Here we follow him in his enthusiastic hunt for inscriptions, and read with interest the stories connected with the Great Wall, which legend, of course, attributed to Alexander the Great.

But the main portion of the book deals with the great trunk route which runs from Teheran, situated close to the site of ancient Rei or Rhages, to Bactria; and here again we join Alexander, who pursued Darius Codomannus, the last Achæmenian Great King, along this very road, and finally overtook him to find him murdered by Bessus, his trusted kinsman.

A monograph dealing with the *Caspiae Portae* and the site of Hekatompylos is promised, and, with regard to the former vexed question, it is interesting to note that the conclusions come to by our President, himself a great authority on Persia, are confirmed by the American authority. With regard to Hekatompylos, Jackson maintains the view that Damghan is its site; and it will be interesting to see his reasons, as those in favour of a site in the Gurgan valley are particularly strong. Farther east, in the vicinity of Sabzawar, Jackson lovingly refers to Zoroastrian sites connected with Fire temples, or, again, with battles fought by Iran against Turan in defence of the new faith in the kingdom of Gushtasp, the first royal convert.

The title of the book, adopted probably because the name of Omar

Khayyam is one to conjure with on both sides of the Atlantic, would suggest that the journey ended at Nishapur; but chapters are, in fact, devoted to Meshed and to Tus, the latter being especially suggestive.

To summarize, the narrative is interesting throughout, the illustrations are good and lavishly provided, and a hearty welcome may be extended to this, the latest book of Persian travel.

P. M. S.

PERSIAN TRAVEL.

'By Mountain, Lake, and Plain: Sport in Eastern Persia.' By Major R. L. Kennion. Edinburgh and London: William Blackwood & Sons. 1911.

Nowadays more is expected from the writer of a book of sport than a mere recital of his stalks, and it may at once be said that Major Kennion has provided a delightful bill of fare for his readers, as whether he deals with successful or unsuccessful stalks, his descriptions of the scenery, of the habits of his quarry, and of the idiosyncrasies of his shikari, rivet the attention throughout.

He was fortunate enough to discover a new gazelle in Sistan, to shoot the splendid sheep of Northern Persia, to bag some of its great stags, and, above all, to secure a tiger which is the "Hyrcan tiger" of Shakespeare. He studied wild-fowling in Sistan, and his descriptions of shooting geese from a hiding-place dug in a marsh, with its difficulties and discomforts, with its failures and successes, are thrilling. The chapter on Ahu-Gardani is almost a masterpiece.

The illustrations are excellent and most appropriate. Indeed, so well versed is the author in his subject, that he would make an ideal editor of the *Field* or *Country Life* in the sections which deal with shikar.

P. M. S.

'Palestine.' By G. E. Franklin. (London: Dent, 1911. Pp. xx., 219. *Illustrations.* 10*s.* 6*d.*) The chief reason for the preparation and issue of this volume has avowedly been the large collection of photographs, numbering 350, which it contains. They are very good, though occasionally rather small. The binding of so large a number of plates is no doubt a matter of some difficulty; nevertheless, it is a pity that in some instances the plates have not been bound facing the pages which they are marked to face, or even if they have, that the page does not contain the descriptive matter appropriate to the particular photograph. It is, therefore, sometimes difficult to connect the text and the illustrations. The plate of the Dead sea is a case in point. On this and other grounds, an index would have been valuable, especially as the text contains a great deal of detailed information which will be valuable to travellers in the Holy Land.

'Benares.' By E. B. Havell. (London: Thacker. 2nd edit. Pp. xiii., 226. *Illustrations.* 6*s.* 6*d.*) This is an excellent study of one of the most interesting cities in India, and is illustrated by some very beautiful photographs. It is a tribute both to the interest of the subject and its treatment that a second edition is called for since the first appearance of the book in 1905. It will be found a valuable study of Indian town life, even by those to whom the city itself is not known.

'Gun Running and the Indian North-West Frontier.' By Hon. Arnold Keppell. (London: Murray. 1911. Pp. xiv., 214. *Maps and Illustrations.* 9*s.*) As a geographical study of the North-West Frontier Province this book is of no little interest. The arrangement of the tribal frontier, the passes and chief routes, is ingeniously shown by a diagram illustrating two hands with fingers interlaced, those of the right hand representing the routes running from

independent territory to British posts at the heads of valleys, and those of the left hand the spurs of the mountains extending towards the plain. The author writes from long experience of the natives and their political dealings in this part of the Indian Empire, but subsequently carries us to the Persian gulf and Mekran. He has some interesting paragraphs on the economic conditions of that district, and in particular its water-supply and potentialities for irrigation.

'Sport on the Nilgiris and the Wynaad.' By W. F. Fletcher. (London: Macmillan. 1911. Pp. xviii., 456. *Map and Illustrations.* 12*s. net.*) This volume contains not only interesting narratives of sport, but also much of interest as to the habits and other characteristics of the game, drawn from the author's long experience. There is included a table of mammals found in the district, with their scientific names and comments upon their distribution, and the value of the volume is enhanced by a more than usually good large-scale map of the country round Ootacamund, showing the relief and main and branch roads.

'Eighteen Capitals of China.' By W. E. Geil. (London: Constable. 1911. Pp. xx., 429. *Maps and Illustrations.* 21*s.*) The eighteen capitals are those of the Chinese provinces, which the author visited successively. He provides in a voluminous text a great deal of general description of these cities, and a rather desultory collection of folk tales, personal narrative, and geographical, economic, ethnological, and political notes. Some plans of the cities are provided, sometimes reduced far beyond legibility. The photographs are very numerous and good. The book, in fact, contains no small supply of valuable material, though it is doubtful if it adds so much to Chinese research as is suggested in the introduction by another hand. There appear to have been a certain number of oversights in the proof-reading. It is at least possible to assign a somewhat more satisfactory date to the Great Wall than B.C. —.

AFRICA.

North-East Africa.

'Man and Beast in Eastern Ethiopia.' By J. Bland-Sutton, F.R.C.S. ENG. *With 204 Engravings on Wood.* London: Macmillan & Co., Ltd. 1911. 12*s. net.*

Mr. Bland-Sutton uses the word Ethiopia in the sense now accepted to indicate a particular zoological region. His observations were made in British East Africa, Uganda, and the upper Nile valley. His chapters, or essays, as he prefers to call them, deal with places, persons, and "things," *i.e.* birds, beasts, fishes, and insects. There is a freshness and directness in the style, a simple manner in presenting technical information, which makes this book very welcome. Mr. Bland-Sutton supplements his own observations by liberal recourse to the works of other writers—he has obviously read very widely—and thus this book takes on a kind of encyclopædic air; it has the potted essence of many volumes. Yet we are indebted to Mr. Bland-Sutton himself for much curious information concerning the fauna of East Africa (otherwise available only in highly technical works); for the graphic manner in which he presents each tribe to us; to the quaint humour which makes "Thorns" and "Horns" the headings of two successive essays. It was Alice in Wonderland who used her flamingo as a croquet mallet; the odd slope of a flamingo's head and its apparent clumsiness on the end of a long neck reminded Mr. Bland-Sutton of a golf club. No praise is too high for the beautiful wood engravings which, to one's great relief, replace the customary photographs. They are by various artists; those of birds signed H. Grinvold are perhaps the finest. Altogether this is a notable book, and if to give a vivid impression of a country is an aid to geographical science, then this book fulfils that purpose. F. R. C.

African Climate.

'The Climate of the Continent of Africa.' By A. Knox. Cambridge: University Press. 1911. 531 pp. 13 maps. 21s. *net.*

Books which deal with climatology on any extended scale appear so seldom in this country that a collection of the meteorological data having reference to the various portions of the continent of Africa will be a boon to many who are interested in geography, and to whom the classical work of Hann's 'Handbuch der Klimatologie' is not accessible. Mr. Knox provides a map of the annual mean rainfall of Africa, and also twelve maps on the same scale, 1 : 40,000,000, showing the distribution for each month, and in a prefatory chapter discusses generally the controlling data utilized in drawing these diagrams. This strikes the keynote of the volume, and throughout the important phenomenon of precipitation receives the fullest treatment. A short statement of the general climatic conditions of the main divisions of the continent follows, and serves as an introduction to the detailed description of the climate of different regions, and North Africa, Tropical Africa, and South Africa are adopted as the three natural divisions of the continent, the eastern and western portions of tropical Africa being separately grouped. In each section the political divisions are separately treated, morocco, Algeria, Tunis, Tripoli, Upper and Lower Egypt, together with the Sahara which is here taken as limited to the central portion of the North African desert, being taken as the component parts of the North African climatic region. In each region a short general description of the climate is given with certain statistical data, and usually a paragraph is added relating to the produce which is raised there. Tabular statements are given for the principal meteorological stations in each region wherein the mean monthly values of such climatic factors as have been observed. These vary according to the completeness of the work at the station, but usually the mean daily temperature and the mean maximum and minimum temperatures as well as the mean daily range are given, together with the mean rainfall month by month. Values of other factors are introduced when available, and not infrequently the mean monthly temperatures at the hours of observation are also given in order to represent as fully as possible the meteorological conditions in regions where observations are still far from being complete or systematized. The number of years from which the mean values have been derived is carefully stated, as well as the years which furnished the original observations. This volume therefore provides in a very accessible form a vast collection of data which, except in Prof. Hann's work, is not readily attainable.

In the preface the author states that his work does not pretend in any way to be a meteorological treatise, so that we may take it as having been designed as a conveniently arranged collection of the meteorological statistics of Africa, and such it undoubtedly is. But we question whether the grouping of these statistics by political divisions so strictly is altogether an advantage, for areas essentially the same in climatic character appear in different parts, such as the central Sahara under North Africa and the eastern Sahara from 22° N. lat. southwards, under eastern Tropical Africa; while special phenomena of wide extension are repeatedly referred to under different regions, as in the case of the Harmattan wind. The whole question of the air circulation over Africa is not very prominently discussed, and though observations extending over any considerable period are not numerous, the winds of Africa are a very important climatic factor, and merit a fuller discussion. In this connection a diagram of the distribution of atmospheric pressure on which were shown the prevalent wind

directions, and also the principal storm tracks, so far as these have been determined, would have been a valuable addition, and would have served to emphasize the difference between certain seasonal winds and others in the same area which are directly related to passing cyclonic depressions. A relief map and diagram of the distribution of temperature would also have materially aided the reader. Some of the generalized statements and descriptions drawn from travellers and residents are hardly borne out by the tabulated statistics, and where long series of regular observations are available, such passing observations are of little value. Change of climate, especially in the form of diminished rainfall, is stated to have taken place in certain parts, but such conclusions are most difficult to substantiate satisfactorily, and in the case of Upper Egypt, where the climate is said to be "evidently undergoing a certain amount of change owing to the barrages now erected," the cause adduced is certainly insufficient. References to works consulted are numerous and valuable, but even more convenient would have been a list of the publications in which the observations in each region are now appearing. Values are stated both in British and metric units, and in degrees Fahrenheit and Centigrade.

This work cannot fail to be of great service to students and teachers of geography, as bringing within their reach a mass of carefully collected and arranged data not hitherto accessible to them. H. G. L.

'Twilight Tales of the Black Baganda.' By Mrs. A. B. Fisher. (London: Marshall. *N.d.* Pp. x., 198. *Illustrations.* 3*s.* 6*d. net.*) The writer persuaded the kings of Toro and Bunyoro to set down in writing the history of their country. It proved a curious and interesting experience, and this small volume provides not only entertaining and often humorous reading, but also considerable addition to the knowledge of the natives of the country with which it deals. There is ample reference to folk tales, and also to missionary work.

'Hausa Sayings and Folk-Lore.' By R. S. Fletcher. (London: Frowde. 1912. Pp. 173. 3*s.* 6*d.*) This little volume is intended both as a guide to the Hausa's "mental and physical modes of recreation," and as an addition to the knowledge of the spoken language. The latter purpose is aided by a vocabulary of "new" words. Phrases, riddles and sayings, customs, gestures, and art are among the subjects dealt with, in addition to the actual transcription of stories and traditions.

'Cook's Handbook for Egypt and the Egyptian Sûdân.' By E. A. Wallis Budge. (London: Cook. 1911. 3rd edit. Pp. xx., 950. *Maps and Illustrations.* 10*s. net.*) This well-known guide, which is in reality an expansion from the author's volume on the Nile, first issued in 1886, has been revised to date, is well provided with good maps, and could hardly be improved.

'The Illustrated Guide to Algiers.' By J. C. Hyam. (Algiers: Hyam & Co. 1911. 8th ed. Pp. xi., 226. *Maps and Illustrations.* 6*s.*) This guide, rather roughly produced as it is, is full of useful matter, and bears evidence of having been carefully brought up to date.

'Mines of Africa.' By R. R. Mabson. (London: "The Statist." 1911–12. Pp. xlii., 891. *Maps and Plans.* 21*s.*) The present edition of 'Mines of Africa,' which has become an annual, contains reference to Rhodesian and West African mines, by which its scope and bulk are considerably enlarged over former editions. By the alphabetical arrangement adopted, it is possible to refer very easily to any individual mine. A large number of plans are provided, and also some special maps, such as that of the geology of southern Rhodesia.

'Pioneers in West Africa.' By Sir Harry Johnston. (London: Blackie. 1911. Pp. 336. *Maps and Illustrations.* 6*s.*) In this volume Sir Harry Johnston probably feels himself more at home than in the volume on Canada, previously noticed. There is at all events more evidence of the results of his own African work, and the substance of that work undoubtedly lends a greater value to the present volume. It is excellently illustrated with photographs and coloured illustrations from Sir Harry Johnston's own brush, which are very fairly reproduced.

AMERICA.

Labrador.

'Through Trackless Labrador.' By H. Hesketh Prichard. London: Heinemann. 1911. 15*s. net.*

In his journey across the Labrador plateau from the coast to Indian House lake on the George river, Mr. Prichard struck entirely new ground. Mrs. Hubbard and Mr. Dillon Wallace a few years ago reached the lake from Hamilton inlet, but the route from Nunaingoak bay by the Fraser river had never been traversed. Canoes were used up the Fraser river as far as possible, then the route was on foot with packs over the plateau. The journey, though not a long one either in distance or time, was arduous, and one that demanded able organization as a safeguard against starvation. The return journey was over exactly the same route as the outward one, so that *caches* of food could be left. Although only half this large volume is occupied with an account of the actual journey, we cannot help feeling that the story is rather spun out and loaded with much detail which, while adding no doubt to its popular interest, somewhat detracts from its geographical value. However, this criticism must not be pressed, since books like this are written for a wide public, and Mr. Prichard succeeds well in giving a vivid picture of the "abomination of desolation" afforded by the interior of Labrador.

The remaining half of the volume treats of the natural history, the Indians, and the missionaries in Labrador. For these Moravian and other missionaries the author has nothing but praise. The treatment of the Indians, Eskimo, and other inhabitants is geographical in its correlation of environment and activity throughout. The author has an unfortunate statement on page 2, where he attributes the difference in climate between the west of Scotland and Labrador to the former possessing "the genial warmth brought from the tropics by the Gulf Stream."

This attractive volume will specially appeal to the sportsman intending to visit Labrador, for Mr. Prichard devotes much space to that aspect of the country, on which he writes with authority. He concludes that a traveller in the interior is not safe in trusting to caribou, but that he may depend on some fish and small game. The success of Mr. Prichard's trek across Labrador is largely proof of this. Curiously enough, the plague of mosquitoes turned out to be worse on higher ground than in the valleys, and it adds materially to the drawbacks of Labrador travel.

There are numerous well-reproduced photographs, but a larger map would not have been amiss. R. N. R. B.

The Canadian Rockies.

'The Canadian Rockies, New and Old Trails.' By A. P. Coleman, PH.D., F.R.S., Prof. of Geology in the University of Toronto. London: Fisher Unwin. 1911. *Maps and Illustrations.* 12*s.* 6*d. net.*

This book on 'The Canadian Rockies' is one of very great interest. It is not the record of a single journey to that great range of mountains in North

America, but of many. The first was undertaken in 1884, and the last in 1908, nearly a quarter of a century later.

Prof. Coleman was the pioneer of mountaineering and exploration in the Canadian Rockies after the Canadian Pacific Railway was built to these mountains of the West. He has been in the Selkirks, and backwards and forwards in the Rocky mountains from Laggan in the south to Mount Robson far away to the north, at the headwaters of the Frazer river. It was he who first settled accurately the height of Mount Brown and Mount Hooker. For nearly seventy years these two peaks had been masquerading on the maps as 16,000 feet and 17,000 feet high; to Prof. Coleman belongs the credit of having visited them in 1892, and proved that 9000 feet was about their real height. During his wanderings amongst the mountains he discovered many new mountains, glaciers, and lakes. He visited the headwaters of the Brazeau river, the Athabasca river, and others; he discovered a new pass from the Frazer river to the Smoky river and the north of Mount Robson; in fact, the Canadian Government owes him a debt of gratitude for all the information and the maps he has published of a part of their country practically unknown.

The book is most delightfully written, for it is by a man who knows his subject thoroughly, by a man who has fought time after time with the dense woods, the swollen swiftly-running rivers, the snowstorms, the avalanches, and the troubles that are the lot of those who wander in this new land. Moreover, it is not a book written in a hurry; for a quarter of a century Prof. Coleman accumulated his material, and not till then did he write his book.

Of adventures that might at any moment have cost the party their lives, there are not a few in the book. One of the most graphic is the "Running the Surprise Rapids," on the Columbia river. "We paddled desperately to keep clear of a sharp island of rock; the waves seemed mountains high and we began to wonder if we should get through them alive . . . for our raft was revolving end for end, and then a great billow fell upon us sideways, and the raft overturned. There was a moment under water . . . then I dragged myself upon the upturned bottom of the raft . . . We had missed the island . . . the raft plunging and revolving . . . the waves half smothering us from time to time, and now right ahead was the worst point of all—what the Ottawa raftsmen call a 'cellar,' when the water sinks down in front of a ledge of rock, and flings itself back as a towering wave. A sensation of sinking into the depths, followed by a deluge of water leaping and trampling upon us, and then the raft struck heavily," etc. His final comment is, "Transport by raft had certainly saved us some time, for we had come down at least 4 miles in fifteen or twenty minutes." This was in 1888; twenty years later, in 1908, he gives another description, this time of an attempt to climb Mount Robson, and it was as bold and hazardous as his journey down the Columbia on a raft.

But there is much more in the book than tales of adventure. Prof. Coleman is one of those people to whom all things are interesting: the mountains, the valleys, the dense woods, the open spaces on the passes, where all the wild flowers can be found, the wild animals, goats, bears, and sheep, the geology of the country, the camp life, all these he writes about in such a manner that to those who know the life it brings back the great longing for the wilds once more; and to those who have not been on the trail in the Canadian Rockies, the splendid photographs that are to be found in the book will give an excellent idea of this country as it was in the days of the pioneers, and as it still is, once away from the beaten trails.

J. N. C.

PATAGONIA.

'The Wilds of Patagonia.' By Carl Skottsberg, D.SC. London: Edward Arnold. 1911. 15*s. net.*

Modest in its equipment and means, the expedition which Dr. Skottsberg led to South America and the Falkland islands succeeded in covering a really remarkable extent of ground in a comparatively short space of time. The eagerness of the leader to push on, to tackle one piece of work after another, and his almost meteoric activity are reflected in his writing. In some 300 pages of large type the reader is hurried through the Falkland islands, introduced to most of the coasts of Fuegia, rushed up the Patagonian channels to Chiloe, is taken to Valparaiso, and into the heart of Chile, sees the trans-Andine railway, gets a few days on Juan Fernandez, and then is carried southward east of the Andes through Patagonia to Lakes Buenos Aires, Belgrano, and Argentino, back to the straits of Magellan and the Beagle channel, and finally, to cap this whirlwind journey, is conveyed for two or three weeks to South Georgia. Between October, 1907, and May, 1909, all this was accomplished.

It is seldom that a book of travel can be criticized for the meagreness of its details, but in this volume it seems unfortunate that Dr. Skottsberg has touched so lightly on the numerous important investigations he conducted, and has left us hungering for more information on the fruits of his extensive wanderings. In most cases he has done little more than hint at his important results. Most interesting, but disappointingly brief, is the author's record of the unearthed remains of a comparatively recent forest of coniferous trees in one of the most westerly of the Falkland group. For several years report of this discovery of heavy timber had been known, but Dr. Skottsberg was the first to settle definitely that it was not due to driftwood. During the Ice age the Falklands seem to have experienced an excessively wet climate, and one in which all the winter snows melted in summer, with the result that the ground became so saturated that it slid downhill, carrying blocks and *débris* of all sizes to the valleys. Thus it was that the forests were covered, and in this way also Dr. Skottsberg believes the famous stone-rivers were formed. Certainly the Falklands seem to show no trace of ice-action in the way of moraines, striæ, and *roches moutonnées*.

Dr. Skottsberg complains bitterly of the colonization of the Juan Fernandez islands by Chile, and he would have them preserved untouched because of their botanical interest. Certainly, if their only value to Chile is for the dumping of convicts, it is a pity they should be settled at all.

The volume is vividly written, and gives an excellent descriptive account of Patagonia and the Falklands, but it would have been none the less readable had the author told us more of his work and results. It makes us anticipate with interest further instalments of the scientific publications of the expedition, and causes us to hope that Dr. Skottsberg will conduct further successful exploration.

There are numerous excellent illustrations and two satisfactory maps.

R. N. R. B.

THE MONTHLY RECORD.

EUROPE.

Ice on the German Coasts and its Influence on Shipping.—An interesting discussion of the ice-conditions on the German coasts, based on eight years' systematic observations, appears in the *Annalen der Hydrographie* for December, 1911. As was to be expected, the prime factor in determining the amount of ice is the temperature of the different localities. Thus both a decrease of temperature and an increase of the number of days in which ice is recorded take place with some regularity from west to east, both on the North sea and on the Baltic coast of Germany. On the former the variation due to temperature alone, though perceptible, is not great, but on the Baltic coast the number of ice-days increases steadily and rapidly towards the east. Other factors come into play also on both coasts, there being naturally, as a general rule, more ice in the inlets than on the projections of the coast into the open sea. Of the ports of the North sea, those about the mouth of the Weser are less blocked by ice than those near the Elbe and Eider, all of which latter record from 28 to 31 ice-days in the year. In regard to the Baltic ports, a noticeable fact is the comparative freedom from ice of Kiel, which is, perhaps, to be ascribed to the somewhat higher surface temperature observed there, and partly also the orientation of the harbour, which permits the ice to be carried out to sea by the prevailing south-west winds, the influence of which is traceable at other points too. In the "Haffs" of the more eastern part of the coast the ice-days become more and more numerous, and in the Frische Haff reach the high total of 110. The neighbourhood of Danzig is generally kept more or less free by the fact that the ice from the mouth of the Vistula is carried out to sea through the new cut at Schiewenhorst. When a north-east wind blows, however, this ice is carried back into Danzig bay, which becomes almost entirely blocked. In discussing the disturbing influence of the ice on shipping (limited mainly to the Baltic portion of the coast) a distinction is drawn between days on which (*a*) navigation by sailing-ships, (*b*) that by steamships, is stopped. A good deal of difference is to be seen between the various ports, irrespective of easterly position. Thus on the Schleswig coast east of Rendsburg, steam-navigation is stopped on an average for 20 days in the year, while near Stettin hardly any stoppage is experienced; the latter fact being due partly to the activity of the port and the use of ice-breakers. The extent to which navigation is impeded varies of course greatly from year to year.

The Last Eruption of Etna (September, 1911).—Prof. Riccò's preliminary report on this important eruption is published in the *Bollettino* of the Italian Seismological Society (vol. 15, pp. 273–280). After a pause of about three months' duration, a period of renewed activity began on May 27 with the formation of a new vent on the north-east flank of the central crater at a short distance below the summit. The preparation for the eruption continued during August and culminated during the night of September 9–10, when the ground trembled almost incessantly, and a great fracture 5 miles long appeared in the central crater, starting from the new vent of May 27 and running towards the north-north-east. At 2.14 a.m., on September 10, a strong earthquake occurred, and simultaneously a new vent opened some way below the summit. Three more appeared within a few hours, and were followed on the next day by the formation of a large number of others. These were arranged in groups, apparently along the great fracture, and from them were emitted masses of

smoke, scoriæ, lapilli, and stones, which in a few days formed cones of considerable height around the openings. On September 11 lava-streams began to flow from two of the lowest vents; the larger of the two streams flowed rapidly (at the rate of 6 or 7 miles an hour) down the slope towards the north-east, and soon crossed the circumetnean railway, which is now blocked up for a distance of half a mile by a mass of lava nearly 100 feet in thickness. After lasting a fortnight, the eruption gradually ceased, the total result being the formation of more than 110 new vents of various sizes arranged along a line running at first to the north-north-east and afterwards to the north-east, the discharge of enormous quantities of dust and stones, and the emission of two streams of lava, the front of which advanced to about 1¼ mile below the circumetnean railway.

The Caverns and Underground Channels of Greece.—Under the title "Les Katavothres de Grèce" Mr. N. N. A. Siderides gives, in Nos. 63–64 of *Spelunca*, a useful descriptive summary of the most remarkable of these features, based almost entirely on his own explorations, and fully illustrated by views, plans, and diagrams. As regards the Peloponnese, the explorations were carried out so far back as 1892, but no full account of them appears to have previously been published. Those in the vicinity of the Lake of Copais were made in 1910 in company with Mr. R. S. Cole, chief engineer of the English company which is exploiting the lake, who has explored all the underground passages in its neighbourhood, and who recommends that some of them be cleared out to help to carry off the flood water of the lake in case of need. At present this is done by a series of canals and tunnels constructed a quarter of a century ago by a French company. The caverns seen by Mr. Siderides were: (1) that of Palaiomylos, about the centre of the eastern shore of the lake, which, from the Dragon gate near its entrance, extends as a winding passage, first due east for a hundred yards as far as a large chamber, and then due north for a similar distance, when further advance becomes impracticable. This passage probably takes the surplus water into Lake Likeri, 2 miles to the south-east. (2) The Great Katovothra, at the north-east extremity of the lake, at present blocked near its entrance by a great fall of rock. This formerly received all the waters of the river Melas, which are now carried off by one of the canals above mentioned. (3) The Katavothra of Bynia, a short distance north of the last-named, which, judging from the size of the channel leading to it, seems to have once been the most important of all. It has two entrances, one of which again bifurcates, but none of the passages can be followed for any distance. The larger part of the paper is devoted to the Katavothræ of the Peloponnese, some of which were explored by Mr. Martel in 1891, and the remainder by Mr. Siderides in the following year. The greater number lie in the elevated north-central portion of the Peloponnese, running northward from the neighbourhood of Tripolis, which is entirely without visible drainage to the sea, but forms eight separate basins with subterranean outlets. Three other such basins occur near the base of the south-eastern peninsula. Many of the caverns are very extensive, with a complex series of chambers, abysses, and passages. In a number of cases the passages have become blocked by vegetable and other *débris* carried into them, and therefore no longer fulfil their function of carrying off the surface drainage. The result is that stagnant swamps are formed, which increase the unhealthiness of the country, besides being detrimental to agriculture. It is of great importance that the passages should be cleared and suitable measures taken to prevent the ingress of anything but water. From a scientific point of view the caves merit study as much as those of any similar

region of Europe. Mr. Siderides has proved that the water has everywhere made use of joints and fractures in the rock, and that, contrary to the opinion of Dr. Philippson, there is nowhere any trace of subsidence.

ASIA.

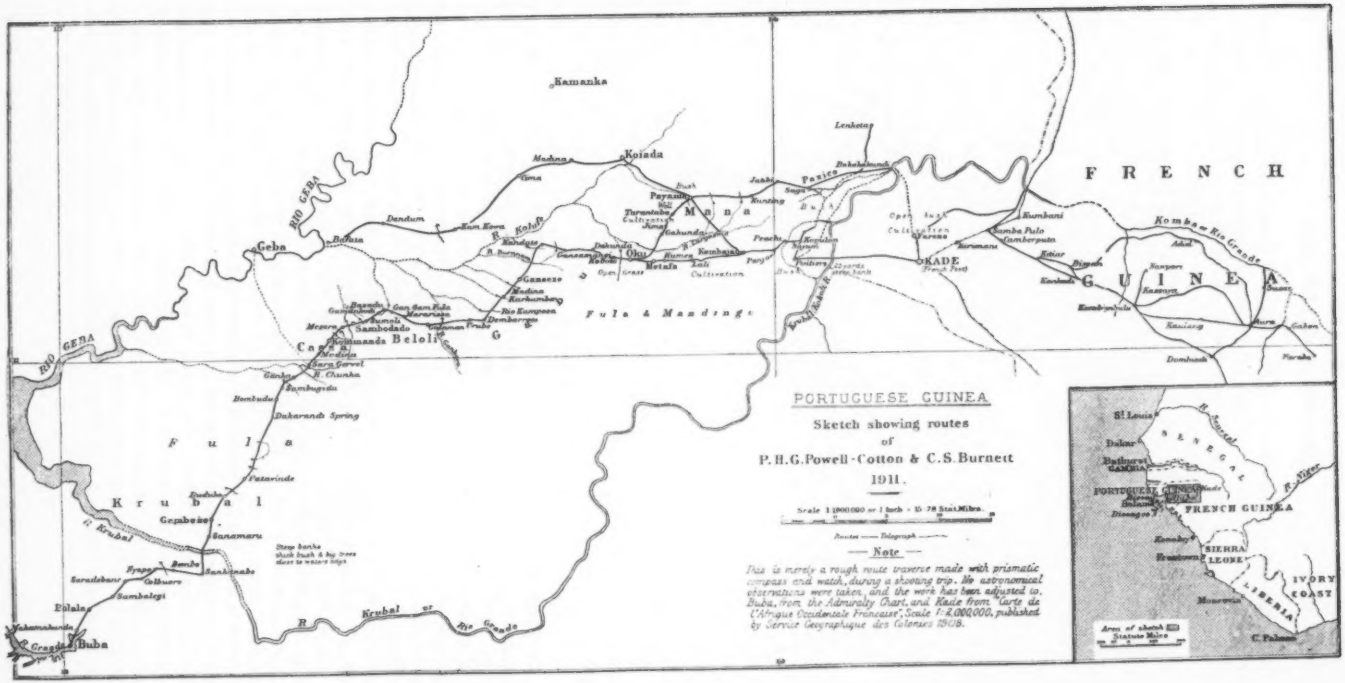
Exploration Work with the Abor Expedition.—The Indian papers bring the following information regarding exploration work in the Dihong and neighbouring valleys down to February 29. Bad weather had impeded the work of the Dihong exploration party, and the river had risen 6 feet in the night of the 4th. At Getti an altitude of 8000 feet had been reached, and the ground was covered with 2 feet of snow. Eventually the party pushed as far north as Shinging, but it then returned to Shimong, not being able to proceed further owing to the impossibility of obtaining supplies. There is no mention of the discovery of any great falls of the Dihong; native reports deny their existence, and affirm that many rapids are to be found, but no falls. Survey work was still proceeding round Shimong. The exploration party in the Yam-ne valley had passed through Damroh, and reached Milian on February 5, after which, having completed the reconnaissance of the snow range north of Damroh, it returned to Rotung. It was found impossible to work westward to join up with the Dihong exploration party, owing to enmity between the Padam and the Shamong Abors. At the date mentioned the expedition was being brought to a close, but the survey parties were still in the field. The following notes have been gathered on the habits and customs of the people: The Abors are of Tibeto-Burman origin, and speak a language which is allied to that of the Tibetans, while their arts, such as they are, come from Tibet. Their religion is animistic, comprising a belief in a future state, the worship of certain sylvan deities and their propitiation, the use of charms and omens, and a noted aversion to work. The deity Plang is the god of war and the chase, and is believed to favour attacks on defenceless neighbours and the ruthless destruction of game. The elemental belief in man as the hunter still holds good; so the women and slaves toil unceasingly, while their lords stalk off on the war-path. The juju and the fetish of Africa and the totem of the Red Indians all have their counterpart among the Abors. They grow cotton, tobacco, and opium, and cultivate bamboo, plantains, and lemons. Their womenfolk are attired in coloured cloths of their own weaving, while the men wear fleecy cotton coats. In their features one can sometimes trace a resemblance to the Tibetans, and their crafty looks sometimes suggest the Celestial, while on the whole they appear intelligent. The latest news is to the effect that the survey parties would not advance further north, so that the supposed sites of the falls at Pemakoi would not be visited. The Mishmi mission under Mr. W. G. Dundas had returned to Sadiya, but the Miri expedition was still out under Mr. Kerwood. The weather had continued to be the great obstacle to survey work.

The Flora of Daghestan.—Mr. N. J. Kutznetsof has studied the flora of the highlands of Daghestan, chiefly in relation to the other parts of the Caucasus (*Izvestiya* of the Russian Geographical Society, Nos. 6 and 7, 1910). As the country dried gradually after it was raised from the sea in Tertiary times it was occupied by dry alpine forms of vegetation, which were reinforced in the Glacial period by polar species and alpine species from the west; and also by forest trees such as the Scotch fir and white birch, though, in consequence of the rawness of the climate and the nature of the soil, forests were never extensive. Hence, when steppes were developed, some of these mountain forms spread south, east, and west to other parts of the Caucasus, and a few even beyond its limits.

The Kamchatka River.—Mr. Lebedef, of the Ryabushinski expedition (*ante*, p. 281), explored this river in 1908–9 (*Izvestiya* Russian Geog. Soc., Nos. 1–5, 1911), noticing on his journey that the Shchapinskaya volcano, reported extinct by Postels and Ditmar, was sending up a large column of steam. The western source stream of the Kamchatka, the river Kenuzhen, collects its waters from the central range which has here a plateau character, and the two streams are swift and full of rapids for the 25 miles above their confluence. From the village Sheroma to Mashuri, about 60 miles, it is navigable in boats, and the discharge is about 2470 cubic feet per second, with a velocity of more than 3 miles an hour. Below this place the river is also navigable by river barges of slight draught down to Nizhne-Kamchatsk. This is the most varied section of its course. At first forming rapids, under favourable circumstances, and shallows, the stream becomes gradually quieter below the Tolbachinsk summer settlements, with a breadth of 200 yards, a velocity of 2 miles an hour, and a maximum depth of 16½ feet. From Nizhne-Kamchatsk to its mouth the river is navigable by vessels drawing not more than 5 feet of water. Here the river has a breadth of 360 yards, a mean depth of 18 feet, and a discharge of about 39,400 cubic feet a second, so that, at the end of August, when the snow melts, the volume of its water is not less than that of the Dnieper at average low water, though the basin of this river is ten times larger. The Kamchatka is fed chiefly by melted snow and ice, springs and lakes, and only to a small extent by rain. It requires a greater aggregate of low temperatures to freeze it than any of the rivers of Siberia, except the lower Angara, probably owing to the high temperature of the springs. The lakes of eastern Kamchatka are not colder in summer than similar European lakes, and in winter even warmer, being frozen over earlier. The hot springs visited by Mr. Lebedef are distinguished from the usual Kamchatka type by the abundance of calcareous deposits. Hot springs lie in an unbroken succession from the Nalochavsk to the Ukinsk springs. A map of the delta of the Kamchatka river accompanies the article.

AFRICA.

Portuguese Guinea.—Major Powell-Cotton spent five months shooting in Portuguese and French Guinea last year, accompanied during part of the time by Mr. C. S. Burnett. We have received a sketch-map of their routes, based for the most part on a compass survey by Mr. Burnett, a reduction of which accompanies the present note. The following details have been supplied by the travellers jointly. Portuguese Guinea is little visited by Englishmen, yet it is only twelve days' trip from England *viâ* Lisbon and the Portuguese coast-line, and slightly longer by German cargo steamer from Hamburg. For water transport the country is peculiarly well adapted, as a series of creeks run inland for many miles, while the three large rivers, Cacheo, Geba, and Krubal, are navigable for long distances. Off the coast lie the Bissagos islands, green with luxuriant vegetation, and capable of far higher production than is at present extracted from the fertile soil. Portuguese Guinea itself is mostly flat and park-like, mounting gradually towards the east, till in the neighbourhood of the French frontier the hills rise to an elevation of some 700 feet. Owing to heavy night dews the land remains remarkably green even throughout the dry season, which lasts from October to May. The jungle that heavily fringes the river banks contains fine trees, stretches of bamboo, palms and rubber vines, while here and there the natives have made extensive clearings for the cultivation of rice, ground-nuts, and the usual West African cereals. They also breed herds of cattle, horses, sheep,


PORTUGUESE GUINEA
Sketch showing routes
of
P. H. G. Powell-Cotton & C. S. Burnett
1911.
Scale 1:1000000 or 1 Inch = 15.78 Stat. Miles.
Route —— Telegraph ——
— Note —
This is merely a rough route traverse made with prismatic compass and watch, during a shooting trip. No astronomical observations were taken, and the work has been adjusted to Buba, from the Admiralty Chart, and Route from "Carte de l'Afrique Occidentale Française", Scale 1:1,000,000, published by Service Geographique des Colonies 1908.
Kamanka
Koiada
Gebu
RIO GEBA
Madina
Gima
Pandum
Sam Kowa
Kohel R.
Payama
Turantaba
Kuntang
Jabbi
Panica
Bukkakunda
Lenkeita
Kumbani
Samba Palo
Tamberputa
Barmani
Kolior
Pingala
Kombo
Rio Grande
Adiel
Kasanga
Kasanga
Kambadju
Kambadju
Kambadju

and goats. The capital, Bolama, on an island at the mouth of the Rio Grande, is the centre of a rich trade, mainly carried on by French, German, Belgian, and Italian companies. Not a single British firm is to be found, and only one large Portuguese house. Bissau, the second town of importance, also built on an island, is enclosed by a fine old wall. Gold is said to have been found in the vicinity. The pressing need here, as at Bolama, is a deep water pier to permit of vessels being loaded direct. The chief exports, ground-nuts, palm kernels, rubber, gum arabic, and hides, could with a little enterprise be increased enormously; while a big trade in cotton, rice, and cattle might speedily be built up. Along the river Geba a new trading town has arisen within the last two years at Bafata, now a most flourishing centre of commerce carried on towards and over the French frontier, in part surreptitiously. The country is so level, and yet free from swamps, that bullock cart-roads might be made with little expense. These would link up the navigable stretches of the rivers, and bring to the ports products of the fertile interior which at present do not pay to transport by men. The towns leave much to be desired in the matter of sanitation and water supply, and are consequently unhealthy; but in the interior the climate compares favourably with Equatorial Africa, except at the beginning of the rains. In the dry season mosquitos are only troublesome near water. Throughout the midday hours the temperature ranges between 96° and 99° in the shade of the tent. The inhabitants of the interior are chiefly Fulas, who most of them acknowledge one paramount chief, Monjur. The coast regions, on the contrary, are divided among many small tribes. Their attitude is friendly to white men, and more especially to the British, but a traveller encounters considerable difficulty in procuring porters. The game list includes elephant, hippo, buffalo, giant eland, leopards, jungle cats, hyæna, jackal, wild dogs, waterbuck, roan, hartebeest, cob, bushbuck, reedbuck, oribi, duiker, chimpanzee, and monkeys. As nearly every native carries a gun, and spends his spare moments wandering about the jungle on the chance of getting a shot, the sportsman must be prepared for exceedingly hard work, endless disappointments, and a meagre bag.

Nigeria.—The union of Northern and Southern Nigeria into one government, which had been under consideration for some time, was decided on during February, and it is announced that the first governor of the whole territory will be Sir Frederick Lugard, to whom Nigeria already owes so much. The virtual completion of the railway from the Baro on the Niger to Kano, with its connection with the Lagos line by way of Jebba and Zungeru, has supplied a link between the two protectorates and thus paved the way for their amalgamation. The recent Colonial Report on Northern Nigeria gives details of the progress of the Baro-Kano railway from its inception to the arrival of the rails at Kano in March, 1911. The latter event rendered possible the immediate opening of the line to traffic, though the bridging was then still incomplete and was not expected to be finished till early in the present year. The line is claimed as a triumph of economy, and with its eventual extensions * will, it is said, revolutionize the conditions of the Protectorate and render it self-supporting at no distant date. It has already not only had a marked effect on markets and districts within a wide radius, but also has exercised an educative influence on the primitive inhabitants of districts never before brought in touch with European methods. The year dealt with in

* One of these is a branch to the Bauchi tin-fields, on which such good progress had been made early in the present year that its completion at the end of March was anticipated.

the report (1910–11) was particularly favourable for water transport, both Niger and Benue having risen to a good height during the flood, while a good depth was maintained during the low-water period. Altogether the report places the prospects of the Protectorate in a distinctly favourable light.

Austrian Expedition to Northern Uganda.—Last autumn an expedition for ethnological and other research set out for the region between Lake Rudolf and the Nile, under the leadership of Dr. R. Kmunke, who had obtained the support of the Protectorate authorities for his undertaking. According to the third number of *Petermanns Mitteilungen* for the present year, the members of the expedition effected the ascent of Mount Elgon in December, pitching their camp in the crater at an elevation of 12,500 feet, and thence climbing to the highest point north of the crater. The expedition then proceeded to Lake Salisbury *en route* for Nimule.

Italian Surveys in Africa.—The Italian occupation of Tripoli has emphasized the need of more accurate surveys of that country to supplement the exceedingly rough work of the kind hitherto executed. According to the *Revista Geografica Italiana* for December last, a party from the Military Geographical Institute was to set out in January, under Col. Eugenio Caputo and Prof. Antonio Loperfido (head of the Geodetic Office), in order to begin work to provide a precise basis for future surveys. The first operations would be the astronomical determination of the position of Tripoli, the measurement of a base-line, and tidal observations for the determination of an altimetric datum. The position of Tripoli, it is stated, was determined with considerable accuracy only five years ago, under the direction of Prof. E. Millosevich. The same number of the *Revista* records the progress so far made with the surveys near the mouth of the Jub, to which reference was made in the *Journal*, vol. **36**, p. 360. It has been found necessary to adopt the scale of 1 : 50,000 for the plotting of the survey, and in view of the slight relief of the surface precise levelling has been decided on. The survey is being referred to a pillar near Jumbo, of which the co-ordinates have been fixed by the marine surveyors as S. lat. 0° 14′ 50·70″, E. long. 42° 37′ 27·58″.

AMERICA.

Canadian Hydrographic Surveys: Hudson Strait and Bay.—The *Report of the Department of Naval Service* for the year ended March 31, 1911, contains, among other items of hydrographical work, an account of the voyage to Hudson Bay carried out in 1910 for the purpose of testing the conditions of navigation and examining the rival claims of Ports Nelson and Churchill to selection as a terminus of the proposed railway to the bay. The survey parties were taken out in the ice-breaking steamer *Stanley*, in charge of Commander J. B. Miles, supported by Captain Dalton and (as ice-pilot) by Captain S. W. Bartlett. On the Labrador coast great numbers of icebergs were met with, but it seems probable that, by keeping 50 miles out from the land, they would be in great measure avoided. In Hudson strait and bay large quantities of ice were encountered, but (except in the eastern part of the strait) in the form of ice-fields, not bergs. Some of the ice had its origin in Ungava bay, which was occupied by a solid ice-field, but some, in Captain Bartlett's opinion, was Arctic ice. A narrow passage on the south side of the strait was, however, kept fairly clear by tidal streams. The largest field, continuous for 200 miles, was in the bay itself, and though it presented no very serious obstacle to a specially constructed ship, Commander Miles expresses the opinion that no cargo vessel of ordinary construction would have been able to find or force her way through. The difficulties on this score are,

however, by no means insurmountable, and the main dangers at present arise from the inaccuracies of the chart; the land and islands appearing in some cases to be from 15 to 20 miles out of longitude. The representations of mainland and islands often bear little resemblance to the reality. The evil reputation of Hudson bay by reason of the supposed effect of local attraction, and the resulting inaccuracy of the compass, seems not to be justified, the change of variation being normal, though rapid, as shown by the almost hourly observations taken. The charted lines of variation require correction, however; the zero line, *e.g.*, lying about 30 miles east of its charted position. As regards the two ports examined, no final opinion is expressed as to their relative merits, though Port Churchill would seem to possess some decided advantages, principally in the comparative ease with which it may be approached, and the better shelter afforded, though the anchorage is at present limited. The inner port is too shallow to be of use, and, by impounding large quantities of water during flood tide, adds to the strength of the current through the entrance at ebb. This objection could be obviated by the construction of a dyke. At Nelson river the shallowness of the water off the coast is a drawback, and when the large volume of water discharged, combined with the ebb tide, sets against the heavy northerly gales which prevail in August and September, a very bad sea is raised. Among the other surveys reported on, those of the Queen Charlotte group and adjacent parts of the Pacific coast are perhaps the most important.

Messrs. Stefansson and Anderson among the Eskimo of Northern Canada.—Further news of these travellers (*Journal*, vol. **38**, p. 626) is given in the *Bulletin* of the American Geographical Society for December, 1911. In March of that year they had proceeded up Dease river to Dismal lake and the Coppermine, crossing over from Bloody fall to the coast near Richardson river. Searching for Eskimo, they followed the chain of islands in Coronation gulf eastward, obtaining driftwood for their camp fires from the islands, which are three or four times as numerous as the charts indicate. Two villages were at last found near the centre of the gulf, each containing about eighty inhabitants. Only one person had ever seen a white man, though the grandfathers of two of them had seen white men or Indians at one time on the lower Coppermine. Stefánsson hoped to visit all the Eskimo living on the coast of Victoria Land, while Anderson was to devote the summer to collecting.

Mr. Radford's Journeys in Northern Canada.—The American naturalist, Mr. H. V. Radford, whose investigations of the habitat of the wood bison were referred to in vol. **35**, p. 596, has reported to the American Geographical Society on subsequent journeys, both east and west of the Great Slave lake, as well as on that lake itself (*Bulletin, American Geographical Society*, 1911, pp. 134, 777; 1912, p. 46). Although his main attention is given to natural history collecting, he claims to have made some geographical discoveries also. In December, 1910, after being frozen in at Port Vermilion on the Peace river, he crossed the habitat of the wood bison by a new route, and has prepared maps of the country hereabouts as well as of that to the east of the Slave river. Last year he and his assistant, Mr. T. G. Street, of Ottawa, went to Fort Resolution on the Great Slave lake, whence they intended to travel east *viâ* Artillery lake to Chesterfield inlet, afterwards going north through the Barren Grounds to the north coast; and his last letter announced their arrival at Artillery lake on July 31, 1911. Mr. Radford says that existing maps of Great Slave lake are very inaccurate; that it really forms two lakes joined by a river only a quarter of a mile wide; and that it does not extend east of 111° 45′ W. long. These statements are not easily reconcilable with the fact that such a competent

surveyor as Mr. J. W. Tyrrell, in 1900, traversed, on the ice, the whole extent of the lake from Fort Resolution eastward to its extremity, and that his observations placed the termination in 108° 44′ 55″ N. ('Report of Surveyor-General, 1900-01,' Appendix 26). Mr. Radford also says that he has discovered a large river—the "Thalson"—600 miles in length, besides many lakes; and the idea naturally suggests itself that this may be the Thelon of Tyrrell, already explored by that traveller, as well as by Mr. David Hambury (cf. *Journal*, vol. **16**, pp. 63 *et seq.*; vol. **20**, p. 340).

Prof. Parker's New Attempt on Mount McKinley.—As already mentioned in the *Journal* (vol. **38**, p. 434), Prof. Parker, after failing in his attempt to ascend Mount McKinley in 1910, planned a new expedition, to be carried out during the winter. From the January number of the *Bulletin of the American Geographical Society*, we learn that he sailed from Seattle for this purpose on January 24, again accompanied by Mr. Belmore Brown and his other companions of 1910. It is proposed to ascend the Susitna river and its western branch, the Chulitna, and cross the Alaskan range to the north-east side of the mountain, from which the ascent will be attempted. The outfit is being taken in two sledges drawn by Eskimo dogs, and the professor hoped to begin the main climb by April 1.

The Key West Railway.—On January 22, 1912, there was formally opened to traffic one of the most remarkable railways yet constructed, even in these days of daring engineering schemes, as is to be gathered from an account in the *Bulletin* of the Pan-American Union for February. The railway to Key West, the important naval station of the United States in the centre of the channel between Florida and Cuba, is an extension of the Florida East Coast railway, which had gradually been extended south until it reached Homestead, at the southern extremity of the peninsula. Hitherto it had served the needs of tourists and those interested in the development of Florida, and its later extension had been mainly due to the enterprise of Mr. H. M. Flagler, who, on his retirement from business, had made himself a winter home in Florida. To him also was due the bold idea of carrying on the line across the 156 miles of intervening sea between the mainland and Key West, making use of such support as was offered by the keys of coral rock which encircle the lower end of the peninsula, but depending elsewhere on concrete laid in open water or on viaducts with their foundations in the bed of the sea. These last are not required until Long Key is reached, but to the south-west of that island they soon begin, the first having a length of over two miles, and forming a series of 180 arches of reinforced concrete. Further on, between Knight's Key and Big Pine Key, a distance of 13 miles, there are three viaducts totalling 4 miles, crossing water 30 feet deep. At one part the line actually passes out of sight of land. Besides giving for the first time a railway connection between the mainland and Key West, the line will do much to facilitate communications with Habana, only 90 miles from Key West, across which interval it should be possible to establish an ocean ferry to carry both passenger and freight cars. The importance of Key West is sure to be greatly enhanced by the railway, more especially in connection with the opening of the Panama canal, one gateway to which it commands. Already a new dry dock and ten covered piers, giving berths for 40 large vessels, have been constructed. The railway does not entirely block navigation, as drawbridges are placed across the most frequented channels.

Dr. Koch-Grünberg's New Expedition in Northern Brazil.—News of this traveller's progress down to November last appears in *Petermanns*

Mitteilungen for December, 1911, and February, 1912. This time Dr. Koch has chosen the imperfectly known region about the headwaters of the Rio Branco, the great northern branch of the Rio Negro, as the field for his ethnological researches. From July onwards he had traversed the borderlands between Brazil, Venezuela, and British Guiana in various directions. Crossing the water-parting into the basin of the Caroni, he had reached and ascended Mount Roraima, experiencing very low temperatures (by comparison with those recorded only a few days to the south) both on the summit and at the foot of the mountain. He had made exhaustive studies of the habits, customs, and languages of the natives (Taulipang, Wapiskana, Arekuna, etc.), and had secured a large number of photographs, kinematographs, and phonograph records, besides carrying out a survey of the route, and barometer and thermometer observations. From São Marcos—the centre of a wide cattle-rearing district between the Uraricuera (the western branch of the Rio Branco) and the Venezuelan frontier—he was about to start up the little-known valley of that river, intending to continue his ethnological researches in the direction of the upper Orinoco, possibly pushing on eventually to the upper Rio Negro.

Archæological Expedition to the Argentine and Chilian Andes.—Mr. Eric Boman, the Swedish traveller whose work entitled 'Antiquités de la région Andine,' etc. (forming part of the reports on the French Scientific Expedition to the Andine region in 1903), was reviewed in vol. **36**, p. 212, informs us that he has started this year on a new expedition to the Cordillera of Argentina and Chile, for the purpose of continuing his researches into Calchaqui, or more properly the Diaguitan, civilization. Mr. Boman, who is supported by the Swedish Anthropological and Geographical Society, will pay special attention to the extent of ground occupied by this prehistoric people in the southern Andine provinces of Argentina, and possibly in Chile.

Dr. Max Schmidt's Researches in the Brazil-Bolivian Borderlands.—It is mentioned in the March number of *Petermanns Mitteilungen* that Dr. Max Schmidt, of the Berlin Ethnological Museum, has lately completed some interesting researches among the headwaters of the Paraguay and Guapore, in a part of Matto Grosso lately made more accessible by the work of Major Candido Rondon (*Journal*, vol. **31**, p. 568). An examination of the artificial mounds on the Caracara, a little-known tributary of the São Lourenço, showed them to be the work of the ancestors of the present inhabitants, the Guatos, and that they belong to a cultural epoch comparable with the older Stone age. Dr. Schmidt afterwards visited the source-region of the Jaurú, Juruena, and Guapore, studying the Paressi Indians, who are comparatively recent immigrants to this region, having exterminated the men of the older inhabitants, the Cabixis, while amalgamating with the women and children.

AUSTRALASIA AND PACIFIC ISLANDS.

The Water-resources of Australia.—The *Times* of February 10, 1912, has an article on Australian water-supply and on the great progress which has been made in Australia in conserving the winter floods on the rivers of the Murray system, and in better provision for withstanding periods of drought. The agricultural prosperity of recent years is not due to abundant rainfall, as the amount for the last five years has been below the average. The article deals mainly with the distribution of the well waters in eastern central Australia, of which an account was given in the articles by Prof. Gregory published in the *Geographical Journal*, vol. **38**, 1911, pp. 34–59, 157–181. The *Times* article refers to the great economic importance of these well waters and to the efforts that are being made by chemical treatment to render them more serviceable

for agriculture. There is no difficulty in the laboratory in converting the bicarbonate of soda into a useful product; but the difficulties of applying these processes profitably on a large scale have not yet been overcome. The *Times* article refers to the discovery that the water from one of the bores is radio-active, which gives further support to the view that some of it is of plutonic origin.

POLAR REGIONS.

The American Arctic Expedition.—Mr. George Borup, whose proposed expedition to Crocker Land, in company with Prof. D. B. Macmillan, has already been referred to in the *Journal* (vol. **38**, p. 78, and *ante*, p. 288), sends us a full account of the programme of the expedition, which supplements to some extent the published reports. He points out that the probable existence of Crocker Land rests not only on its supposed sighting by Peary, but on Mr. R. A. Harris's deductive studies of tidal records for the seas north of Asia and America (see review of his 'Arctic Tides,' in vol. **38**, p. 312). According to present plans, the final start from Cape Hubbard will be made about the last week in February, 1913, and soundings will be taken *en route* with a view to supplementing those of Peary and so determining the extent of the continental shelf in this region. The two months in Crocker Land will be used for topographical, geological, and physiographical studies, and tidal observations will also be carried out, if possible. In order that the expedition may yield valuable results even in case of a failure to reach the supposed land, attention will be paid throughout to geology, meteorology, tidal observations, ethnology, birds, mammals, and fishes. The study of cycles of erosion in the Arctic should, it is pointed out, yield interesting results in view of possible climatic changes, and any light obtained on the structural geology would be useful as indicating the character and extent of the larger earth-movements in those regions. It is proposed to make a thorough study of glaciers, glacial motion, and erosion by ice-caps, as well as of the "glacial fringe" on the shore of the Polar sea, which to a limited extent resembles the great Ross barrier in the Antarctic, and on the north-east coast of Grant Land extends about 5 miles off shore. The fringe is a combination of glaciers from the land with the heavy ice of the fiords. The proposed expedition into the interior of Greenland due east from Whale island will, it is hoped, supplement the data obtained by Peary in the north, and by Nansen and others in the south. By the use of box kites an attempt will be made to secure data as to the temperature and direction of the upper air currents, while another novel feature will be the proposed use of the new adaptation of colour photography to moving pictures, depicting phases of Eskimo and animal life.

The Australian Antarctic Expedition.—The return of Dr. Mawson's ship, the *Aurora*, to Hobart was announced on March 12. She brought the news that Dr. Mawson's party had been landed on the Antarctic continent on January 19, and Wilde's party on February 19. No trace had been found of the supposed Clairie Land, thought to have been seen by D'Urville in 1838, and it is suggested that what the French navigator saw was an ice-barrier which has since broken up. The *Aurora* started homewards on February 21, and will return south next spring. It is stated that Captain Amundsen is sending Dr. Mawson 21 dogs and two sledges used by him on his South Pole expedition.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Evaporation from Lakes.—Precise data respecting the rate of evaporation from lakes or other water-surfaces under various conditions have hitherto been almost entirely lacking, any figures hitherto obtained being quite incapable of general application, as is shown by the enormous variation in the estimates of

greatest possible evaporation used by water engineers for one and the same climatic area. The question is of great practical importance, yet the complicated nature of the observations needed to determine the average rate of evaporation over a large water area renders its solution a matter of great difficulty. An exceptional period of heat and drought, such as the summer of 1911, offers special advantages for the investigation, as it permits an insight into the approximate *maximum* of evaporation for the climatic region in question; and this opportunity was promptly seized by Prof. J. Maurer for observations on two of the lakes on the north side of the Alps—the lake of Zürich and the Greifensee—the results of which are published by him in the *Meteorologische Zeitschrift* for December, 1911. In order to obtain any trustworthy results, it is of course necessary to determine carefully (1) the total water brought into the lake during a given period, both by its main and subsidiary feeders; (2) the total carried away by the effluent; (3) the variation in the level; (4) the total rainfall over the surface. The fact that in the drou^{g}'t of 1911 most of the secondary feeders of the lakes in question had practically run dry seems to have somewhat simplified the task; * but even so the securing the necessary data was a matter of considerable labour, and was only possible with the fullest utilization of sources of information, such as the observations of the Government Meteorological and Hydrological Departments and various public bodies. The results of the observations were worked out by a graphic method which much reduced the amount of calculation necessary, curves being laid down on squared paper for the daily amount of inflow and outflow, the excess of the latter (which was a positive quantity during the whole period of observation in August and September) being obtained from the number of squares intercepted. Curves for the meteorological elements were also drawn. For August the average daily loss by evaporation worked out as 4·7 millimetres for the Greifensee and 4·6 for the Lake of Zürich. In September, in spite of the continuance of extreme conditions, the daily loss was considerably less. Seeing that the temperature was from 3°·9 to 5° C. in excess of the normal during the period of observation, the above figures may be accepted as the maximum of evaporation from a free lake-surface in the climatic area in question.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

The Distribution of the Kayak.—Mr. David MacRitchie sends us some notes on the distribution of the kayak, taking the word in its common acceptation as the long, narrow, skin-covered canoe of the Eskimo, with which race it appears everywhere in association. In East Greenland precise references to it are found in connection with the Angmagsalik region, between 65° and 66° N., in the reports of the Danish expeditions to this coast. Here kayaks were found belonging to women, though these almost invariably use the large open umiak instead. In the eighteenth century, the Eskimo of the St. Lawrence coast were accustomed to cross over into Newfoundland, and Dr. Packard, in his book on 'The Labrador Coast' (1891), quotes Cartwright's statement that he saw an Eskimo pursuing a "penguin" (great auk) near Fogo island, Newfoundland, south of 50°. This is the most southward limit of the kayak in modern times, though the eleventh-century Norsemen encountered the craft still further south. According to Packard, the Labrador kayaks are framed of

* Incidentally, the paper gives some interesting figures showing the enormous variation, at such a period, in the flow of streams according as they are fed by the melting of glaciers or otherwise. Thus the Upper Rhone, from a collecting ground of only 5220 square kilometres, showed a flow equal to that of the Upper Rhine, derived from an area seven times as great.

spruce wood, whilst those of Greenland are framed with bone. Wood is certainly used, however, by some Greenland tribes, and we read of wood-framed kayaks in early and recent accounts of the natives of Hudson strait, Davis strait, and Smith sound. On the western coast of Greenland, the limit of the kayak may be placed in 79° N., in which latitude a temporary home of Eskimo was found by Peary. Among the Arctic islands, and all over the Arctic coasts of North America, the kayak is in use wherever the Eskimo are able to live. In western Alaska, a considerable variety of shape is to be found, as described by Mr. E. W. Nelson. Besides the slender canoe of the eastern tribes there are others of heavier build, with square-cut stem; and a short, single-bladed paddle is also used. We find here, too, the kayak with two, and even three, man-holes, as seen and described by Cook in the eighteenth century—a form entirely wanting from the Mackenzie river to Angmagsalik. At the present day the two-holed kayak does not extend west of 160° E., the western limit of the Chukches. But in early times it was seen far to the west of this. As early as 1556 Stephen Burrough spoke of the boats made of deer-skins, which the Samoyedes carried with them on their backs, just as is done by the Eskimo with their kayaks. A century later we have a more definite account in the 'Voyage des Pais Septentrionaux' of Martinière, who speaks of a canoe captured during the Danish Expedition of 1653 as in the style of a gondola, cleverly constructed of fish-ribs covered with fish-skins stitched together. It formed a sort of purse within which two men were enclosed up to the waist in such manner that not a drop of water could enter. This, Mr. MacRitchie holds, is undoubtedly the two-holed kayak, and he suggests that a link between these people of northern Russia and the Aleutians may formerly have existed in the now-extinct Onkilon or "sea-folk" of the Siberian coast. More remarkable still is the occasional occurrence of the kayak in the Orkneys in comparatively modern times, of which evidence is afforded by the Rev. James Wallace, minister of Kirkwall, in the Orkneys, in the latter part of the seventeenth century, and by his son, Dr. James Wallace, F.R.S. A specimen of these was preserved in the Physicians' Hall, Edinburgh, and another, captured near Aberdeen two centuries ago, is to be seen in the Marischal College Anthropological Museum. As the woodwork of this has been pronounced to be of *Pinus silvestris*, a tree unknown in Greenland and America, the natural inference is that this kayak was of North European construction.

A Relic from Bligh's Voyage in the "Bounty."—Messrs. Maggs Brothers have lately offered for sale an interesting relic from the ill-fated voyage of the *Bounty*, in the form of a volume taken by the commander Bligh on the voyage, containing additions in his autograph—among them his private log of the voyage, occupying twelve pages. The volume begins with a "Table for the Ready Projection of a Mercator's Chart" in Bligh's own hand, and this is followed by three printed works, the first being, 'Instructions relative to the Transit of Venus;' whence it has been concluded by a former owner that the book was in Bligh's possession while with Cook on his "Voyage to observe the Transit of Venus." As this was the first voyage of the great navigator, in which Bligh did not take part, this is, of course, incorrect. Moreover, the 'Instructions' bear Bligh's autograph, with date 1775. The manuscript log, which is headed "*Bounty's* track from England towards Otaheite, by Captn. Wm. Bligh," begins on December 4, 1787, the day after leaving Spithead, and ends April 24, 1789, four days before the outbreak of the mutiny, the last entry being, "Anchor'd in Anamoke Road." The printed portions are interspersed with notes in Bligh's autograph.

OBITUARY.

Lieut.-Colonel Henry Strachey.

We have to record the loss of a distinguished geographer, and one who received, so long ago as 1852, the Patron's Medal of this Society. His death took place at Kemendine, Guildford, on February 9 at a great age, being only two weeks short of ninety-six years. He was born at the family place, Sutton Court, Somerset, on February 24, 1816. The second of a family of distinguished brothers, one of whom, the late Lieut.-General Sir Richard Strachey, began his first geographical work in the same part of the Himalayan chain. He entered the service of the H.E.I. Company from Addiscombe, landing in India in December, 1835. His first regiment was the 66th B.N.I. He was employed during his service on special duties, such as the construction of the Grand Trunk Road between Futtehpur and Allahabad (1841–42), and the building of the Kududbia lighthouse on the Chittagong coast (1844–45). But it is to his services as an explorer and map maker I would more especially refer, and when reading his own account of this part of his life, one cannot help being impressed by the fact how eminently fitted he was by disposition, together with his knowledge of the natives of the country and their language, to carry out exploration in a little-known country. His journals are full of details, historic, and ethnologic, etc., which only a traveller proficient in the native languages, in close and friendly intercourse with the inhabitants, can secure.

In 1846, Henry Strachey, then a lieutenant in the above regiment on a year's sick leave to Kumaon, made his famous journey from Almorah, proceeding by way of the Kali valley, to the Manasarowar lake in Tibet, recorded in the *Journal of the Asiatic Society*, 1848. His account is full of the most interesting observations on the people, the meaning and derivation of place-names, and the physical features of the country, particularly when so little was known of it at that time. It was a risky journey in those days; he travelled light, hardly distinguishable in costume from the very natives he had with him, yet thus single-handed he did so much.

The Geographical Society possesses an original map drawn and signed by Henry Strachey, which bears the mark of Addiscombe teaching. I may say here that at that period, and for some years after, the military drawing both at that college and the R.M.C., Sandhurst, was of a high standard, and great attention was paid to it and to surveying.

Strachey's map, on a scale of 50 miles to 1 foot or 1 mile = 0·24 inch, embraces all the country he went through to reach the two lakes, Cho Lojan (Rakas Tal) source of the Sutlej, and Cho Mapan (Manasarawar) source of the Brahmaputra, including Kailas peak and range adjacent. Westward the line of the Snowy range to Garhwal. He compiled this map of the frontier from his own journeys, and all the available sources of information based on the Indian Atlas sheets as far as the country had been surveyed at that time, 1846.

After exploration of this nature, carried on in intervals of leave from his regiment, it was only to be expected that a few years later, the Indian Government requiring knowledge of newly acquired territory on the Panjab frontier, Henry Strachey was appointed to the Kashmir Boundary Commission, the other members being Major Alex. Cunningham, R.E., and Dr. T. Thomson, and he was able again to prosecute survey in the Tibetan Himalaya. On this service of nearly two years he mapped the country down the Indus into Rupshu and as far as Leh, a very creditable piece of single-handed work ("Physical Geography of Western Tibet," *R.G.S. Journal*, vol. **23**). He finally retired from the service in 1861. Most unfortunately for

Strachey, he lost his sight about thirteen years ago, but his memory was wonderful for the minor physical features of the Himalayas he had seen, and it was always a great pleasure to go over ground with him. Up to the last years of his life he took a deep interest in all that had been done in the surveying and exploring line since his early days. He married Miss Cloete, of Newlands, Cape of Good Hope, and had one daughter, married to Sir William Chance. Both his wife and daughter survive him.

H. H. G.-A.

Augustus Henry Keane, LL.D.

In the death of Dr. A. H. Keane, which took place on February 3, the Society has lost one who has made valuable contributions to anthropogeography, not so much by way of original investigation as by laborious compilation and co-ordination. Dr. Keane was born at Cork in 1835; his student days were passed in Dublin, Rome, and other places, and concluded by his graduating with honours in the Roman Catholic College in Dublin. After studying for two years in Germany he devoted himself to literary work, and published his first important book in 1878, a 'History of the English Language.' For a time he taught English, German, French, and Hindustani at the Hartley Institute, Southampton, and subsequently held till 1885 the professorship of Hindustani created for him at University College, London. After visiting the United States to lecture on ethnological subjects he settled down in 1889 at Hampstead, where the remaining years of his life were spent.

Besides numerous contributions to the *Geographical Journal*, Dr. Keane wrote many articles on ethnological subjects for the *Journal of the Anthropological Institute*, the *Academy*, and various encyclopædias; as typical of his admirable synthetic method, we may mention one 'On the Relation of the Indo-Chinese and Inter-Oceanic Races and Languages' and 'The Ethnology of the Egyptian Sudan,' in the *Journ. Anth. Inst.* for 1880 and 1884 respectively. All geographers will be familiar with his excellent monographs on Asia, Africa, Central America and West Indies, and South America in 'Stanford's Compendium of Geography and Travel.' Amongst other publications are 'The Boer States, Land, and People' (1900), 'The Gold of Ophir' (1901), 'The World's Peoples' (1908); and numerous translations—for instance, 'The Earth and its Inhabitants' (Elisée Reclus), 'Peruvian Antiquities' (W. Reiss and A. Stübel), 'The Science of Language' (Abel Hovelacque), 'Philosophy, Historical and Critical' (A. Lefèvre), 'Travels in Africa' (W. Junker), and 'The Second Deluge' (J. Rodenberg).

The works of outstanding merit which proclaim Dr. Keane's mastership of his subject are his 'Ethnology' (1898) and 'Man, Past and Present' (1899). In the former he has dealt with the problems of the antiquity of man and his physical and mental evolution, criteria of race, and primary ethnical classification. 'Man, Past and Present,' wherein is summarized the ethnology of peoples the world over, is the *vade mecum* of every serious student of the subject.

Dr. Keane possessed a remarkably wide acquaintance with the literature of anthropology, and he held strong views on certain subjects which he was prepared to vindicate by an appeal to the facts which he regarded as cogent. He was never in a position to prosecute researches in the field, but he was endowed with an extraordinary gift for presenting the results of others in a lucid form. It is for this comparative and expository work, as well as for his linguistic labours, that he will always be held in grateful remembrance by those interested in anthropology.

A. C. Haddon.

Prof. George Davidson.

The veteran American geographer, Prof. George Davidson, died at San Francisco, where his home had been for many years, on December 2, 1911, aged eighty-seven. He had first gone to California over sixty years ago, as an assistant in the Coast Survey during the gold rush to that region; and during his official work on that coast, continued over nearly forty-five years and involving no ordinary amount of strenuous work, gained an acquaintance with its features such as it falls to few to possess—an acquaintance, in fact, which he found of much service in connection with his studies of early voyages to this part of America. He accompanied the first official expedition sent to Alaska after that territory had been acquired by the United States, and determined the geographical co-ordinates of the most important places touched at. He took charge of a number of Government expeditions for the observation of astronomical phenomena, including both solar eclipses and transits of Venus, and he took part in the international scheme for observations in connection with latitude variation. He was for many years President of the Pacific Geographical Society, of which he may be said to have been the mainstay during his whole connection with it. His geographical studies, devoted largely to the elucidation of doubtful points in the narratives of the early visitors to the west coast of North America, form the bulk of its publications, and he was, besides, the author of a large number of books and papers on astronomy, engineering, and other subjects. Among these his 'Pacific Coast Pilot' is a mine of information on the geography and history of the coast. In 1870 he was appointed Professor of Geography at the University of California, and in 1909 received the Daly medal of the American Geographical Society. He was an Honorary Vice-President of the Sierra Club, and had been an Honorary Corresponding Member of our Society since 1890.

Commander E. C. Dubois-Phillips, R.N.

We regret to record the death of Staff-Commander Dubois-Phillips, which took place, as the result of pneumonia following a chill, on February 28, at his residence at Birkdale, Lancashire. The deceased, who had been a Fellow of the R.G.S. since 1893, was secretary of the Liverpool Geographical Society, which owed much to his zealous interest in its welfare. For a number of years he had been connected with Liverpool as head of a well-known firm of chart correctors, employed by most of the large shipping companies having dealings with that port; and he was also actively connected with various public organizations, including the Liverpool Lifeboat Committee and the Liverpool Shipwreck and Humane Society. He was a constant attendant at the meetings of the Geographical Section of the British Association.

CORRESPONDENCE.

The Tsetse Fly and Big Game.

I OBSERVE with some satisfaction that in the *Journal* for March, Captain Lloyd, speaking of Kordofan, supports the theory reiterated in a lecture given by Sir Alfred Sharpe before the Society in December last, that the tsetse fly in Central Africa does not depend for its existence upon big game.

In the course of a journey across Central Africa in 1907, from the west coast to the east—from Boma to Mombasa—which, in addition to the Congo Free State, German and British East Africa, embraced a tour off the main route of some 2000 miles in the Katanga, I observed somewhat closely both the habits and the habitat of the tsetse. So far as the *Glossina morsitans* is concerned, I failed to trace any connection between the fly and the presence of big game; although I frequently

found both present in many districts, I got some of my best shooting where there was no fly, and I was worst bitten where there was no game.

During last year, as the files of the local press would prove, there was a considerable amount of correspondence in Rhodesia on the subject under consideration, and I think I am right in saying that the majority of travellers in Southern and Northern Rhodesia rejected the theory that the various kinds of tsetse depend for their existence upon the buffalo or any other animal, and they were of opinion that the blotting out of the fly was not to be sought by the indiscriminate destruction of big game.

G. B. Beak, M.A. oxon., F.R.G.S.,
British Consulate-General, Genoa.

March 8, 1912.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1911-1912.

Seventh Meeting, February 12, 1912. Major Leonard Darwin, Vice-President, in the Chair.

Elections.—*Charles Hubert Beadnell; Arthur Harold W. Bentick; Philip A. Benton; Henry C. Brown; Captain Andrew Coats, D.S.O.; Frank Cream; Captain Robert A. French-Brewster; Irwin Leslie Gordon; William Hume L. Hitchcock.*

The paper read was:—

"Exploration in Papua." By the Hon. Miles Staniforth Smith.

Eighth Meeting, February 26, 1912. Major Leonard Darwin, Vice-President, in the Chair.

Elections.—*Major David Phelips Chapman, M.V.O.; Matthew Davenport Hill; Major C. A. R. Hutchinson (21st Dogras); Harry Leney; Captain C. Melville, I.M.S. (Hodson's Horse); Major T. R. Swinburne (late R.M.A.); Captain A. St. J. L. Winterbotham.*

The paper read was:—

'The Economic Geography of the Tyne.' By A. J. Sargent.

Ninth Meeting, March 11, 1912.—Major Leonard Darwin, Vice-President, in the Chair.

Elections.—*Richard William Armitage; David Armitage Bannerman; Harry Hinsley Burgham; Daniel Crawford; Vice-Admiral Sir Frederick Inglefield, K.C.B.; Pierce E. O'Brien-Butler; G. Valentin Oldham; J. G. Macgowan; William Newcombe Musgrave; Horace Pearson; W. Stephenson Richmond; Guy Ripley.*

The paper read was:—

"Some New Zealand Volcanoes." By Dr. J. Mackintosh Bell.

SPECIAL LECTURES.

February 9, 13, *and* 15.

Lectures on the "Desert of North Africa." By Captain H. G. Lyons, R.E., F.R.S.

RESEARCH DEPARTMENT.

February 14, 1912.

"Distribution of Early Bronze Age Settlements in Britain." By O. G. S. Crawford.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Europe—Historical. **Berry.**

Europa's childhood and growth: an historical geography of Europe. By A. J. Berry. London: Sir I. Pitman & Sons, [1911]. Size 7½ × 5, pp. 282. *Sketch-maps and Illustrations. Price 2s. Presented by the Publishers.*

Europe's history in outline, with some reference to the geographical basis.

Germany—Silesia. **Partsch.**

Schlesien: eine Landeskunde für das deutsche Volk auf wissenschaftlicher Grundlage, bearbeitet von Dr. Joseph Partsch. 2 vols. Breslau: F. Hirt, 1896–1911. Size 9½ × 6½, pp. (vol. 1) xii. and 420; (vol. 2) xvi. and 690. *Maps and Illustrations. Price (whole work)* 34 *m. Presented by the Publisher.*

Russia—Finland. **Young.**

Finland: the land of a thousand lakes. By Ernest Young. London: Chapman & Hall, 1912. Size 9 × 6, pp. xii. and 314. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Russia—Kursk. *Iz. Imp. Russ. G.S.* **46** (1910): 109–178. **Oppokof.**

Rivers and marshes of the Suja district, Kursk Government. By E. V. Oppokof. *Illustrations and Profile.* [In Russian.]

Russia—Urals. *Petermanns M.* **57** (1911) II.: 185–187. **Hey.**

Vorläufige Ergebnisse der russischen Expedition in den polaren Ural in Sommer 1909.

See note in the January number, p. 69.

Russia—Urals. *Iz. Imp. Russ. G.S.* **46** (1910) : 35–51. **Baklund and Kuznetzof.**

The expedition of the brothers Kuznetzof to the Arctic Urals in 1909. By O. O. Baklund. *Illustrations.* [In Russian.]

Russia—West Russia. *Petermanns M.* **57** (1911) II. : 235–237, 296–298. **Kuchinka.**

Das Polesie im westlichen Russland. Von Hauptm. G. Kuchinka. *Map.*

Treats of the region between the Dneipr and the Bug, watered by the Pripet and its tributaries.

Russian Empire—Geology. **Mushketof.**

Zap. Imp. Russ. G.S., Gen. G. **39** (1910) : 1–614.

Collected Works of I. V. Mushketof. Part I. 1872–1882. *Maps, Diagrams, and Illustrations.* [In Russian.]

South-West Europe—Ethnology. **Wilke.**

Südwesteuropäische Megalithkultur und ihre Beziehungen zum Orient. Von Georg Wilke. (Mannus-Bibliothek, herausgegeben von Prof. Dr. Gustaf Kossinna, No. 7.) Würzburg : C. Kabitzsch, 1912 [1911]. Size 10½ × 7, pp. iv. and 182. *Illustrations. Price* 7.50*m. Presented by the Publisher.*

Spain—Majorca. **Leclercq.**

Jules Leclercq. Voyage à l'île Majorque. 2e édn. Paris : Plon, 1912. Size 7½ × 5, pp. 284. *Map and Illustrations. Presented by the Author.*

Switzerland—Climatology. **Maurer and others.**

Das Klima der Schweiz. Auf Grundlage der 37-jährigen Beobachtungsperiode 1864–1900 bearbeitet von J. Maurer, R. Billwiller, und C. Hess. 2 vols. Frauenfeld : Huber & Co., 1909–10. Size 12½ × 10, pp. (vol. 1) viii. and 302 ; (vol. 2) vi. and 218. *Maps and Diagrams. Price* 20 *fr.*

Turkey—Salt industry. *B.S.G. Italiana IV.* **12** (1911) : 968–974. ———

Le saline della Turchia. *Illustrations.*

United Kingdom—Archæology. ———

Report of the Committee on Ancient Earthworks and Fortified Enclosures. Prepared for presentation to the Congress of Archæological Societies, July 5, 1911. Size 8½ × 5½, pp. 12.

United Kingdom—Buckingham. **Davies.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Buckinghamshire. By Dr. A. Morley Davies. Cambridge : University Press, 1912. Size 7½ × 5, pp. xii. and 222. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Midlothian. **McCallum.**

Cambridge County Geographies (Scotland ; edited by W. Murison). Midlothian. By Alexander McCallum. Cambridge : University Press, 1912. Size 7½ × 5, pp. x. and 208. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Northampton. **Brown.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard) : Northamptonshire. By M. W. Brown. Cambridge : University Press, 1911. Size 7½ × 5, pp. xii. and 216. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Scotland. **Crampton.**

The vegetation of Caithness considered in relation to the geology. By C. B. Crampton. [Edinburgh, 1911.] Size 9½ × 6, pp. 132. *Sketch-maps, Plans, and Sections.*

ASIA.

Arabia. **Musil.**

Kaiserliche Akademie der Wissenschaften. Arabia Petræa. Von Alois Musil. II. Edom ; topographischer Reisebericht (2 Teile) ; III. Ethnologischer Reisebericht. Vienna : A. Hölder, 1907–08. Size 10 × 7, pp. (ii. 1) xii. and 344 ; (ii. 2) x. and 300, (iii.) xvi. and 350. *Maps and Illustrations. Presented by the Imperial Academy of Sciences, Vienna.*

Asia—Historical. **Linschoten and Kern.**

Itinerario, voyage ofte schipvaert van Jan Huygen van Linschoten naer Oost ofte Portugaels Indien, 1579–1592. Uitgegeven door Prof. Dr. H. Kern. Two vols.

(Werken uitgegeven door de Linschoten-Vereeniging, II.) The Hague: M. Nijhoff, 1910. Size 19 × 6½, pp. (vol. 1) l. and 238; (vol. 2) x. and 260. *Facsimile Portrait, Maps, and Illustrations. Price 15 Gulden.*

China. **Thomson.**

The Chinese. By John Stuart Thomson. London: T. Werner Laurie, [1911]. Size 9 × 6, pp. vi. and 442. *Illustrations. Price 12s. 6d. Presented by the Publisher.*

China—Railways. **Laboulaye.**

Les chemins de fer de Chine. Par Edouard de Laboulaye. Paris: E. Larose, 1911. Size 9 × 5½, pp. 340. *Map. Price 6s.*

India—Historical. **Sainsbury and Foster.**

A calendar of the Court Minutes, etc., of the East India Company, 1644–1649. By Ethel Bruce Sainsbury, with an Introduction and notes by William Foster. Oxford: Clarendon Press, 1912. Size 9 × 6, pp. xxviii. and 424. *Price 12s. 6d. net. Presented by the India Office.*

Japan—Formosa—Aborigines. **Bureau of Aboriginal Affairs.**

Government of Formosa. Report on the control of the aborigines in Formosa. Bureau of Aboriginal Affairs, Taihoku, 1911. Size pp. iv., iv., and 46. *Maps and Illustrations. Presented by Mr. Rimpei Otsu, Superintendent of the Bureau.*

Persia. **Kennion.**

By mountain, lake, and plain; being sketches of sport in Eastern Persia. By Major R. L. Kennion. Edinburgh, etc.: W. Blackwood & Sons, 1911. Size 9 × 5½, pp. xiv. and 284. *Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

See review, *ante*, p. 385.

Persia and Caucasus. **Jackson.**

From Constantinople to the tomb of Omar Khayyam; travels in Transcaucasia and Northern Persia for historic and literary research. By A. V. Williams Jackson. New York [London: Macmillan & Co.], 1911. Size 9½ × 6, pp. xxxiv. and 318. *Maps and Illustrations. Price 15s. net. Presented by the Publishers.*

Reviewed at p. 384, *ante*.

Russian Turkestan—Earthquake. **Chernychef and others.**

Mém. Comité Géologique, N.S. Livr. **54** (1910): pp. 90.

Das Erdbeben von Andishan am 8/16 Dezember 1902. Von Th. Tschernyschew, M. Bronnikow, V. Weber und A. Faas. *Maps, Illustrations, Sections, and Diagrams.* [In Russian; German *résumé*.]

Siam. **Graham.**

Siam: a handbook of practical, commercial, and political information. By A. W. Graham. London: A. Moring, Ltd., 1912. Size 7½ × 5, pp. xvi. and 638. *Map and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

South-East Asia—Salwin. *Petermanns M.* **58** (1912): I., 19–22, 79–81. **Hammer.**

Die Ergebnisse der Reise der ermordeten Dr. Brunhuber und Schmitz zum oberen Salween. Von Prof. Dr. Martin Hammer. *Map and Illustrations.*

An account of this unfortunate expedition was given by Mr. Rose in the *Journal*, vol. **34**, p. 608. The present illustrations are from the travellers' negatives that were saved.

Turkey—Armenia. *Zemlevyedenie* **17** (1910): No. 2, 66–80. **Berg.**

Notes on the level of some lakes on the Armenian plateau. By L. S. Berg. *Illustrations.* [In Russian.]

Turkey—Asia Minor. *Petermanns M.* **57** (1911) II.: 251–255. **Reinhardt.**

Ueber Meerschaum und Meerschaum-Fundstätten bei Eskischehir in Kleinasien. *Illustrations.*

Turkey—Asia Minor. **Sterrett and others.**

The Cornell Expedition to Asia Minor and the Assyro-Babylonian Orient, organized by J. R. S. Sterrett. Travels and studies in the Nearer East. By A. T. Olmstead, B. B. Charles, and J. E. Wrench. Vol. 1, Part 2: Hittite inscriptions. Ithaca, N.Y., 1911. Size 12½ × 9½, pp. 50. *Illustrations. Presented by J. R. S. Sterrett, Esq.*

AFRICA.

Gambia. **Reeve.**

The Gambia: its history, ancient, mediæval, and modern; together with its geographical, geological, and ethnographical conditions, and a description of the birds, beasts, and fishes found therein. By Henry Fenwick Reeve. London: Smith, Elder & Co., 1912. Size 9½ × 6, pp. xvi. and 288. *Maps and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

Morocco—Tangier. **Routh.**

Tangier: England's lost Atlantic outpost, 1661–1684. By E. M. G. Routh. London: J. Murray, 1912. Size 9 × 6, pp. xxviii. and 388. *Maps, Plans, and Illustrations. Price 12s. net. Presented by the Publisher.*

Nigeria, Northern. **Orr.**

The making of Northern Nigeria. By Captain C. W. J. Orr. London: Macmillan & Co., 1911. Size 9 × 6, pp. x. and 306. *Maps. Price 8s. 6d. net. Presented by the Publishers.*

Nyasaland. **Lyell.**

Nyasaland for the hunter and settler. By D. D. Lyell. London: H. Cox, 1912. Size 9 × 5½, pp. xii. and 104. *Sketch-map and Illustrations. Price 5s. net. Presented by the Publisher.*

South Africa. **Glanville.**

The South African Almanack and Reference Book, 1911–1912. Compiled and edited by Ernest Glanville. (First year of issue.) Cape Town (and London); Argus Publishing Co., 1911. Size 8½ × 5½, pp. xxxii. and 864. *Sketch-maps. Price 5s. Presented by the Publishers.*

A useful work of reference containing a large amount of information on the politics, administration, finance, economics, etc., of South Africa. It may be obtained in this country at 82–85, Fleet Street.

South Africa—Bibliography. **Mendelssohn.**

Mendelssohn's South African Bibliography; being the catalogue raisonné of the Mendelssohn Library of works relating to South Africa, with synoptical, biographical, critical, and bibliographical notes on the volumes and their authors. . . . By Sidney Mendelssohn. Two vols. London: K. Paul, Trench, Trübner & Co., 1910. Size 11½ × 7½, pp. (vol. 1) lxxii. and 1008; (vol. 2) vi. and 1140. *Illustrations. Price 42s. net.*

NORTH AMERICA.

Alaska—Mount McKinley. *Canadian Alpine J.* **3** (1911): 57–72. **Parker and Browne.**

Expedition to Mount McKinley. By Herschel C. Parker and Belmore Browne. *Sketch-map and Illustrations.*

See note in vol. **38**, p. 433.

America—Biogeography. **Scharff.**

Distribution and origin of life in America. By Dr. Robert Francis Scharff. London: Constable & Co., 1911. Size 9 × 6, pp. xvi. and 498. *Sketch-maps. Price 10s. 6d. net. Presented by the Publishers.*

Canada—British Columbia. **Gosnell.**

The Year-Book of British Columbia and Manual of provincial information. (Coronation edition.) By R. E. Gosnell. Victoria, B.C.: Published by authority of the Legislative Assembly, 1911. Size 9 × 6, pp. 358. *Illustrations. Price* $1. *Presented by the Agent-General for British Columbia.*

Includes sections on the physical characters, climate, etc., as well as a survey of the colony by districts.

Canada—Rocky Mountains. *Canadian Alpine J.* **3** (1911): 1–13. **Eaton.**

An expedition to the Freshfield Group. By J. E. C. Eaton. *Illustrations.*

United States—Historical. **Kirkpatrick.**

Timothy Flint: pioneer, missionary, author, editor, 1780–1840. The story of his life among the pioneers and frontiersmen in the Ohio and Mississippi Valley and in New England and the South. By John Ervin Kirkpatrick. Cleveland, Ohio: The A. H. Clark Co., 1911. Size 9½ × 9, pp. 332. *Illustrations. Price* $4 *net.*

United States—Historical. **Robertson.**

Louisiana under the rule of Spain, France, and the United States, 1785–1807. Social, economic, and political conditions of the territory represented in the

Louisiana Purchase, as portrayed in hitherto unpublished contemporary accounts by Dr. Paul Alliot and various Spanish, French, English, and American officials . . . edited . . . by James Alexander Robertson. 2 vols. Cleveland, Ohio: A. H. Clark Co., 1911. Size 9½ × 6, pp. (vol. 1) 376; (vol. 2) 392. *Maps and Plans. Price* $8 *net.*

CENTRAL AND SOUTH AMERICA.

Brazil—Araguaya. **Krause.**

In den Wildnissen Brasiliens: Bericht und Ergebnisse der Leipziger Araguaya-Expedition, 1908. Von Dr. Fritz Krause. Leipzig: R. Voigtländer, 1911. Size 9½ × 7, pp. viii. and 512. *Maps and Illustrations. Price M.*12. *Presented by the Publisher.*

Colombia—Ethnology. **Fabo.**

Fray P. Fabo. Idiomas y etnografia de la region oriental de Colombia. Barcelona, 1911. Size 9 × 6½, pp. 294. *Presented by the Author.*

South America—Communications. **Lhez.**

L'Atlantic: guide pratique pour les passagers de la ligne du Brésil et La Plata. Par J. Lhez. Tarbes: [*published by the Author*, 1911]. Size 7½ × 5, pp. 492. *Plans and Illustrations. Price* 5 *fr.* 50. *Presented by the Author.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia and Malaysia. **Mackellar.**

Scented isles and coral gardens: Torres Straits, German New Guinea and the Dutch East Indies. By C. D. Mackellar. London: J. Murray, 1912. Size 9 × 5½, pp. xiv. and 348. *Illustrations. Price* 15*s. net. Presented by the Publisher.*

New Zealand. **Herz.**

New Zealand: the country and the people. By Max Herz. London: T. Werner Laurie, [1912]. Size 9 × 5½, pp. xii. and 382. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Pacific—Historical. **Roggeveen and Mulert.**

De reis van Mr. Jacob Roggeveen ter ontdekking van het Zuidland (1721–1722). Verzameling van stukken, deze reis en de daraan voorafgaande ontdekkingsplannen van Arend Roggeveen (1675–1676) betreffende, uitgegeven door F. E. Baron Mulert. (Werken uitgegeven door de Linschoten-Vereeniging, IV.) The Hague: M. Nijhoff, 1911. Size 10 × 6½, pp. xxviii. and 332. *Maps, Illustration, and facsimile chart. Price* 7 *Gulden* 50.

The first complete collection of authorities on Roggeveen's voyage that has appeared.

POLAR REGIONS.

Arctic—Exploration. **Nansen.**

In Northern Mists: Arctic exploration in early times. By Fridtjof Nansen. 2 vols. London: W. Heinemann, 1911. Size 10 × 7, pp. (vol. 1) xii. and 384; (vol. 2) ix. and 416. *Facsimile-maps and Illustrations. Price* 30*s. net. Presented by the Publishers.*

MATHEMATICAL GEOGRAPHY.

Geodesy. **Ingram.**

Geodetic surveying and the adjustment of observations (method of least squares). By Edward L. Ingram. London, etc.: McGraw-Hill Book Co., 1911. Size 9½ × 6½, pp. xx. and 390. *Illustrations and Diagrams. Price* 12*s.* 6*d. net. Presented by the Publishers.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography—Salinity. *Petermanns M.* **58** (1912) [i.]: 5–8, 75–76. **Woeikof.**

Der Salzgehalt der Meere und seine Ursachen. Von Prof. Dr. A. Woeikow. *Map.*

Sedimentary Deposits—Clay. **Searle.**

The natural history of clay. By Alfred B. Searle. (Cambridge Manuals of Science and Literature.) Cambridge: University Press, 1912. Size 6½ × 5, pp. viii. and 176. *Illustrations. Price* 1*s. net. Presented by the Publishers.*

An excellent brief account of the physical characters, mode of origin and accumulation, and commercial importance of clays.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Da Vinci. **Venturi.**

Essai sur les ouvrages physico-mathématiques de Léonard de Vinci, avec des fragmens tirés de ses manuscrits, apportés de l'Italie. Par J.-B. Venturi. Milan: V. Nugoli & Co., 1911. Size 12 × 9, pp. 36. *Diagrams. Price 5s.*

Reprint of an early work.

Historical—Early Commerce.

The Periplus of the Erythræan Sea: travel and trade in the Indian Ocean by a merchant of the First Century. Translated from the Greek and annotated by Wilfred H. Schoff. London: Longmans, Green & Co., 1912. Size 9½ × 6, pp. iv. and 324. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Historical—Sea-laws.

Il Consolato del mare. Colla spiegazione di G. L. M. Casaregi. [Reprint, with preface by Odone Sciolla, made on behalf of the Port of Genoa Conservancy.] Turin: Unione Tipografico-Editrice Torinese, 1911. Size 11 × 8½, pp. xxxiv. and 388. *Facsimile Portrait and Title. Price 15s.*

Historical—Voyages. **Vries and Colenbrander.**

Korte historiael ende journaels aenteyckeninge van verscheyden voyagiens in de vier deelen des wereldts-ronde, als Europa, Africa, Asia, ende Amerika gedaen door d. David Pietersz. de Vries. Uitgegeven door Dr. H. T. Colenbrander. (Werken uitgegeven door de Linschoten-Vereeniging, III.) The Hague: M. Nijhoff, 1911. Size 10 × 6½, pp. xliv, [viii.], and 302. *Facsimile Portrait, Maps, and Illustrations. Price 10 Gulden. Presented by the Publisher.*

To be reviewed.

BIOGRAPHY.

Anson. **Anson.**

The life of Admiral Lord Anson, the father of the British Navy, 1697–1762. By Captain Walter Vernon Anson. London: J. Murray, 1912. Size 9 × 5½, pp. xx. and 202. *Map, Portraits, and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

GENERAL.

Aviation and Geography. *Petermanns M.* **58** (1912): I. 65–69. **Hergesell.**

Luftfahrten zur wissenschaftlichen Zwecken. Von Prof. Dr. Hugo Hergesell. *Illustrations.*

Education—Text-books. **Frew.**

Blackie's elementary regional and practical geographies. By David Frew. A first geography of England (pp. 96); The British Isles (pp. 80); Europe (pp. 80); The British Empire overseas (pp. 96). London: Blackie & Son, 1911. Size 7½ × 5 (5½). *Sketch-maps and Diagrams. Prices 8d., 6d., 6d., 8d. Presented by the Publishers.*

Education—Text-book. **Herbertson.**

The Oxford Geographies; edited by Dr. A. J. Herbertson. The Clarendon Geography. Vol. 1. By F. D. Herbertson. Oxford: Clarendon Press, 1912. Size 7½ × 5, pp. viii. and 380. *Sketch-maps, Illustrations, and Diagrams. Price 3s. Presented by the Publishers.*

Geography—Text-book. **Tarr and McMurry.**

World geography (1-vol. edit.). By Ralph S. Tarr and Frank M. McMurry. New York (London: Macmillan & Co.), 1912. Size 9½ × 7½, pp. xiv. and 536. *Maps and Illustrations. Price 5s. 6d. net. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 29, 1912.

1-inch scale maps:—

England and Wales. 3rd edit. Engraved in outline. Sheet 83. *Price* 1*s.*

6-inch scale quarter sheets:—

Cheshire, 5 sheets. **Hampshire,** 2 sheets. **Lancashire,** 2 sheets. **Sussex,** 1 sheet.

1:2500 scale maps:—

With houses stippled and with areas.

Berkshire, 3 sheets. **Cheshire,** 1 sheet. **Lancashire,** 10 sheets. **Sussex,** 32 sheets. **Yorkshire,** 6 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

British Isles—England and Wales. **Railway Clearing House.**

Official Railway Map of England and Wales. Scale 1:712,800 or 1 inch to 11·2 stat. miles. 2 sheets. *Price* 7*s.* Official Railway Map of the Cumberland and Westmorland Districts. Scale 1:126,720 or 1 inch to 2 stat. miles. *Price* 3*s.* 6*d.* Official Railway Map of the East of England. Scale 1:160,000 or 1 inch to 2·5 stat. miles. 2 sheets. *Price* 8*s.* Prepared and published by the Railway Clearing House, London, 1912.

British Isles—London. **Cook and Hammond.**

Electric Railways of London. Map showing railways open, constructing, and authorized, together with those proposed for the Session 1912. Scale 1:15,840 or 4 inches to 1 stat. mile. Compiled by Messrs. Cook and Hammond. Westminster, 1912. *Price* 10*s.* 6*d.*

By clearly distinguished symbols in colour the present state of electric railways is shown, together with lines under construction and proposed. The map itself is lightly printed, so that the special information connected with the railways is not observed.

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1:50,000 or 1·3 inch to 1 stat. mile. Sheet XXXVI.-33, Tignes. Paris: Service Géographique de l'Armée, 1911. *Price* 1.60 *fr. each sheet.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Königreich Preussen. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1:100,000 or 1 inch to 1·6 stat. miles. Sheets (Kupferdruck Ausgabe): 336, Goslar; 407, Berleburg. Berlin: R. Eisenschmidt, 1911. *Price* 1.50*m. each sheet.*

Holland. **Beekman.**

Geschiedkundige Atlas van Nederland. Uitgegeven door de Commissie voor den geschiedkundigen Atlas van Nederland en geteekend door het lid der Commissie A. A. Beekman. Sheets 6, 8, 9, 11, De Republiek in 1795. Scale 1:200,000 or 1 inch to 3·2 stat. miles. The Hague: Martinus Nijhoff, 1911.

This is the first part of an important historical atlas of the Netherlands which has for some time been in course of preparation under the joint superintendence of Prof. Dr. P. J. Blok, Dr. S. Muller, Mr. J. C. Ramaer, Dr. J. C. Overvoorde, Mr. A. A. Beekman, and others. It is intended to publish the whole work in ninety chromo-lithographic sheets, measuring 14 by 19½ inches, six to eight of which are to appear each year; the price to subscribers of the complete atlas being 1.50 *gld.* (2*s.* 6*d.*) per sheet. The first part, which has just been published, contains Sheets 6, 8, 9, and 11 of a map of the Republic in 1795. This is well drawn, and shows the boundaries of provinces and smaller divisions at the time, together with the towns and villages, besides much other detailed information. There is no projection or latitudes and longitudes marked, nor is the scale stated, although it is evidently intended to be 1:200,000. This atlas will doubtless supply a want, for since the appearance of the work of Mr. G. Mees, in 1865, nothing of the kind has been published.

Russia. **Skougarewsky and Kononoff.**

Plan du champ de battaille de Borodino, 7 Septembre 1812. Edition de A. Skougarewsky. Dessiné par N. Kononoff. Scale 1:8400 or 7·5 inches to 1 stat. mile. 6 sheets. St. Petersburg: A. Ilyin, [1911].

A large-scale black and white plan of this famous battlefield, with place-names in Russian and French. Relief is shown by approximate contours or form-lines; but there are no figures to indicate actual heights, and no means of determining what the vertical interval between the lines is intended to be.

ASIA.

Asia. **Service Géographique de l'Armée, Paris.**

Carte de l'Asie. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. Sheet 36° N.

78° E., Djammou-Kachmir. Paris: Service Géographique de l'Armée, 1909. *Price* 1.25 *fr. each sheet.*

AFRICA.

Africa. **Geographical Section, General Staff.**

Africa. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Northern Nigeria. Compiled by the Intelligence Office, Northern Nigeria. Sheets: North B 32–B, Dekina; North B 32–D, Katsina Allah; North C 31–J, Dekala; North C 31–P, Yashikira; North C 32–E, Messau; North C 32–F, Dura; North C 32–R, Lau; North C 33–G, Biu. Published by the Geographical Section, General Staff, War Office. London: E. Stanford, Sifton Praed, T. Fisher Unwin, 1912. *Price* 1s. 6d. *net each sheet. Presented by the Director of Military Operations.*

Africa. **Survey Department, Khartum.**

Africa. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Anglo-Egyptian Sudan. Sheets: 35–I, Wadi Halfa; 65–D, J. Dago; 65–H, Lake Keilak; 66–A, J. Tandik; 66–E, Talodi. Khartum: Survey Office, 1911. *Price* 10 *P.T. each sheet. Presented by the Director of Surveys, Khartum.*

Algeria. **Service Géographique de l'Armée, Paris.**

Carte de l'Algérie. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheet 68, Laghouat (Édition provisoire). Paris: Service Géographique de l'Armée, 1912. *Price* 0·60 *fr. each sheet.*

A provisional sheet of surveys in southern Algeria by French military officers, printed in brown and black.

Algeria. **Service Géographique de l'Armée, Paris.**

Territoires du sud de l'Algérie. Edition provisoire. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheets: Chegga; Mrhaier; Ouargla; Ourlhana; Touggourt. Paris: Service Géographique de l'Armée, 1912. *Price* 0.60 *fr. each sheet.*

These sheets are in continuation of those mentioned in the last number of the *Geographical Journal*, and the region included by them is approximately that extending from 31° 30′ to 34° N. lat. and 5° to 7° E. long. They are provisional issues, printed in brown and black from the surveys of French officers in 1908–09. Numerous heights are given in metres, and the general character of land relief effectively, though somewhat roughly, represented.

Algeria. **Service Géographique de l'Armée, Paris.**

Region du Mzab. Scale 1:200,000 or 1 inch to 3·1 stat. miles. Paris: Service Géographique de l'Armée, 1912. *Price* 0.60 *fr.*

Egypt. **Kaiser.**

Die neue Mariut-Eisenbahn von Alexandrien bis Marsa Matruch. Von Oberingenieur Gustav Kaiser. Scale 1:500,000 or 1 inch to 7·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 25. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

Kamerun. **Moisel.**

Karte von Kamerun, bearbeitet von M. Moisel. Scale 1:300,000 or 1 inch to 4·7 stat. miles. Sheets: E4, Mbere; F1, Ossidinge; F3, Joko; F4, Betare; G1, Buea. Berlin: Dietrich Reimer (Ernst Vohsen), 1911–1912. *Price* 2*m. each sheet. Presented by the Publishers.*

Morocco. **Larras.**

Maroc. Itineraires levés par M. le Capitaine Larras. Scale 1:100,000 or 1 inch to 1·6 stat. miles. 32 sheets. Paris: Service Géographique de l'Armée, 1907. *Price* 0.60 *fr. each sheet.*

Thirty-two sheets compiled from the route surveys of Captain Larras during his recent journeys in Morocco. The map includes only the western part of the country from Tangier to Agadir, but extends from the coast as far east as Fez, Meknas, and Marrakesh. Only the route surveys of Captain Larras are shown, the regions between them being left blank on the map. Plans of the following places are given as insets, on larger scales than the general map: Fez, Mogador, Tarudant, Adadir, Ir' Ir, Rabat, El Araish, Kasr-el-Kabir, Marrakesh, Casablanca, Meknas, Mazagan, and Safi.

Morocco. **Larras.**

Plan de Fès. Levé par M. Larras, Cap^{e} d'Art^{ie} en mission au Maroc. Scale 1:5700 or 11·1 inches to 1 stat. mile. Paris: Service Géographique de l'Armée, 1907. *Price* 0.60 *fr.*

Sierra Leone. **Copland.**

Plan of Free Town, Sierra Leone. Scale 1 : 6000 or 10·5 inches to 1 stat. mile. By Charles A. Copland, A.M.I.C.E., Director of Public Works, Public Works Department, Sierra Leone, 1911.

A provisional issue of a plan printed in black and white only. It shows streets with their names and public buildings, but there is no indication of relief or heights in figures.

Tripoli. **Istituto Geografico Militaire, Florence.**

Carta Dimostrativa della Tripolitania. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Florence: Istituto Geografico Militare, 1911.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 165, Rosebud, revised to November 27, 1911; 213, Athabasca, revised to November 2, 1911; 266, Ribstone Creek, revised to October 23, 1911; 313 Brule, revised to September 23, 1911; 462, Dunvegan, revised to November 22, 1911. Ottawa: Department of the Interior, Topographical Surveys Branch, 1911. *Presented by the Department of the Interior, Ottawa.*

Mexico. **Comision Geografica de Guerra y Fomento.**

Carta de la Republica Mexicana. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheets 19–I–M, Mexico City. Mexico: Comision Geografica de Guerra y Fomento, 1909.

South America. **Jannasch.**

Mittel Argentinien und Mittel Chile zwischen 26. und 35. Grad südl. Br. nach den neuesten Quellen bearbeitet, herausgegeben von Prof. Dr. R. Jannasch. Ausgabe, 1912. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. 4 sheets. Berlin: Leopold Kraatz, 1912.

A new edition of a useful and well-drawn map. Heights are given in metres on the land, while depths in the rivers are in feet. Railways working and projected, roads, mountains, rivers, etc., are all clearly shown in colours and symbols.

United States. **General Land Office, Washington.**

Territory of Arizona; State of Florida; State of Montana; State of North Dakota; State of South Dakota; State of Utah. Compiled from the Official Records of the General Land Office and other sources under the direction of I. P. Berthrong, Chief of Drafting Division, General Land Office. Scale 1 : 760,320 or 1 inch to 12 stat. miles. Washington: Department of the Interior, General Land Office, 1908–1911.

AUSTRALIA.

Australia. **Graebner.**

Verbreitung der Speerschleuder in Australien. Entworfen von Dr. F. Graebner. Scale 1 : 10,000,000 or 1 inch to 157·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang, 1912, I., Tafel 22. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

GENERAL.

World. **Bartholomew.**

The Citizen's Atlas of the World, containing 156 pages of maps and plans, with an Index, a Gazetteer, and Geographical Statistics. Edited by J. G. Bartholomew, LL.D., F.R.G.S. Edinburgh: John Bartholomew & Co., 1912. *Price, bound in Half Morocco, £1 15s. net. Presented by the Publishers.*

It is twelve years since this useful general atlas was last published, so that with the many geographical changes that have taken place since that date, a new edition was certainly needed. The whole work has been revised and brought up to date, and on two of the maps corrections have been made by hand. Several new maps replace the earlier ones, among which may be mentioned a railway map of Central Europe, Palestine, and Australia. The maps contain a considerable amount of detail and a large number of names, but are yet clear and legible. There is an index to place-names and a useful gazetteer at the end.

World. **Debes.**

E. Debes' Neuer Hand-atlas über alle Teile der Erde in 65 Haupt- und über 130 Nebenkarten mit alphabetischen Namenverzeichnis. 4. stark vermehrte und

verbesserte Auflage. Lieferungen 1–7. Leipzig: H. Wagner & E. Debes, 1911. *Price* 80 *Pf. each part.*

The fourth edition of this well-known general atlas, of which the first seven parts are mentioned above, has on the whole been carefully revised and promises to be quite up to the standard of the earlier ones as regards style of execution. In one respect it is an improvement on its predecessors, inasmuch as the hill work is not printed in such a dark colour, a reddish-brown having been substituted for that previously used, which renders it possible to read the names with greater facility. Several additions have been made to the maps, one important one being the inset plan of Berlin which appears on No. 16. The following are the contents of these seven parts: Lieferung 1: No. 24 Westliche Alpenländer, 40 Westasien; Lieferung 2: No. 21 Elsasz-Lothringen und Nordost-Frankreich, 31 Süd- und Mittelskandinavien; Lieferung 3: No. 16 Nord-Deutschland, Mittl. Teil, 53 Polynesische Inselgruppen; Lieferung 4: No. 51 Australien und Ozeanien, 52 Australien; Lieferung 5: No. 1 Planiglobenkarte der Erde zur Darstellung der Bodengestalt und Pflanzendecke, 28 Britische Inseln; Lieferung 6: Nos. 29 and 30 Dänemark und Skandinavien, 36 Balkan-Halbinsel; Lieferung 7: No. 12c Europa, Sprachen- und Völkerkarte, 19 West- und Mitteldeutschland.

World. **Johnston.**

W. & A. K. Johnston's Orographical Atlas. Edinburgh and London: W. & A. Johnston, Ltd., 1912. *Price* 6*d. Presented by the Publishers.*

A cheap little school atlas showing land relief by the layer system in shades of green and reddish-brown, and political boundaries in thick red lines. There are altogether thirty-two maps, and upon these all parts of the world are represented.

World. **Johnston.**

The Outline Geographical Exercise Maps. Edinburgh and London: W. & A. K. Johnston, Ltd., 1912. *Price* ½*d. each. Presented by the Publishers.*

A set of 16 outline maps, showing coast-line only, measuring about 6 × 8½ inches, and intended for school use. In addition to the world and the continents, there are special maps of the British Empire and China. These outlines are all printed in blue.

World. **Lossberg and Behner.**

Weltkarte der Funken- u. Kabel- Telegraphie bearbeitet von Otto von Lossberg und Hermann Behner. Scale 1 : 47,000,000 or 1 inch to 741·7 stat. miles. Berlin: Gea Verlag G. m. b. H., [1912].

An outline chart of the world on Mercator's projection, giving a considerable amount of useful information concerning communications by wireless telegraphy and wireless telegraph stations as well as ordinary telegraph cables. The former is shown in red and the latter in blue. Wireless stations open for general commerce are distinguished by symbols from those for other purposes, such as military and naval wireless stations. A special symbol indicates wireless stations under construction or projected, and red figures on the land show the position of land wireless stations. There is also a useful index table giving the names of coastal wireless stations, with the name of the system and the call sign or letters.

World. **Stevenson.**

Atlas of Portolan Charts. Facsimile of Manuscript in British Museum. Edited by Edward Luther Stevenson, PH.D. New York: The Hispanic Society of America, 1911. *Price* £1 10*s.*

This is a photographic reproduction of an atlas of portolan charts, which was purchased by the British Museum in 1895. The charts are neither signed nor dated, but it is thought probable, from certain indications upon them, that the Vesconte de Maiollo was the author, and that they were constructed about the year 1508. The originals are richly coloured, and are well preserved. The delineation of the coast-lines in many instances is remarkably accurate for such an early date, and shows that the author was a good draughtsman, and had kept himself informed concerning the most recent discoveries. Dr. E. L. Stevenson, who has edited the photographic reproduction of the atlas, has written a short but interesting preface, in which he states that it appears to be, not only the oldest known portolan atlas on whose charts any part of the New World is laid down, but the oldest known atlas in which the coast regions of a very large part of the entire world are represented with a fair approach to accuracy. The Hispanic Society of America is doing excellent work in publishing facsimiles of the early maps and charts, and of this the present is an additional proof. Only 110 copies of the atlas have been printed.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from January 28 to March 2, 1912. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 2386, Scotland, west coast: Cape Wrath to the Flannan isles, including the northern parts of the North Minch and Lewis, 4*s*. 1094, England, east coast: Outer Gabbard to Outer Dowsing, 3*s*. 614, Scotland, east coast: Fortrose and approaches, 2*s*. 1210, Ireland, west coast: Berehaven, 5*s*. 1875, North sea, Germany: Jade river to Norder Piep, including the entrances to the Jade, Weser, and Elbe rivers, 3*s*. 1436, Mediterranean: Plans of anchorages in the Morea: Xyli bay, Vatika bay and Cervi island, Port Ieraka, Monemvasia, 2*s*. 3767, North sea, Germany: Norder Piep to Vortrapp Tief, including Heligoland, 3*s*.—**New Editions.**—Index chart of Admiralty sailing directions, 1*s*. 1698, England, south coast: Dover harbour, 3*s*. 30, England, south coast: Plymouth sound and Hamoaze, 5*s*. 2693, England, east coast: Orwell and Stour rivers, 3*s*. 2339, North sea, general chart, 3*s*. 2304, Norway, west coast: Karmö to Bergen (Plans: Eide, Port Sandvig, Approaches to Lervig, Vik, Noreimsund); new Plan of Odde anchorage on this sheet, 3*s*. 2665, France, west coast: Rio Bidasoa to Pointe d'Arcachon (Plan: Higuer road), 3*s*. 1402 Mediterranean, Italy: Ports Maurizio and Oneglia, 2*s*. 2207 Black sea: River Danube: Mouths of the Kilia branch, Sulina mouth, Ilan-Ada-Si or Fido-Nisi or Serpent island, 2*s*. 1569, Mediterranean sea: Approaches to Bizerta, 2*s*. 2342, Nova Scotia: Gut of Canso, with Chedabucto bay and Madame island, 3*s*. 340, Nova Scotia: Baccaro point to Ram island, 3*s*. 486, West Indies: Jamaica and the Pedro bank, with parts of Cuba and Haïti, 4*s*. 3111, Central America, east coast: Colon harbour, 3*s*. 8*e*, Red sea: sheet 5 (Plans: Asab bay, small strait of Bab-el-Mandeb), 3*s*. 2837*b*, Persian gulf, western sheet (Plans: Khárag and Khárgu, Sheikh Shuaib anchorage, Al Bida harbour): Plan added: Sketch of anchorage inside Ras Tanura, 3*s*. 1781 Borneo, east coast: Dent haven (Plan added): Tawao, 2*s*. 3585, China. Yang-tse-kiang: Approaches to the Wusung river, 3*s*. 2809, China: Yang-tse-kiang: Sheet I., Shanghai to Nanking, 3*s*. 3090, Tasmania: Pavilion point to Risdon ferry, 3*s*.

(*J. D. Potter, Agent.*)

Atlantic. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, March, 1912. Ditto, South Atlantic Ocean, March, April, May, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, February, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, March, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, March, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, April, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Pacific. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, March, 1912. Ditto, South Pacific Ocean, March, April, May, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, April, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Jan Mayen. **Bedford.**

Twelve photographs of Jan Mayen, taken by Her Grace the Duchess of Bedford during the summer of 1911. *Presented by Her Grace the Duchess of Bedford.*

A note on the voyage during which these interesting photographs were taken appeared in the *Geographical Journal* for November last, accompanied by reproductions of two of the photographs themselves. The island is seen from different points of view from the deck of the steam yacht *Sapphire*, upon which Her Grace made the voyage, and the views are well taken and clear.

(1) Approaching Jan Mayen from the south-west; (2) Mount Beerenberg; (3) East side of Mount Beerenberg; (4) South side of Jan Mayen, Mount Beerenberg seen faintly in the distance; (5) Cliffs on south-east coast of Jan Mayen; (6) Wille glacier; (7) East cliffs, with distant view of south-east end of Jan Mayen; (8) Egg Bluff crater, showing steam issuing from the walls; (9) Egg Bluff; (10) Egg Bluff and low-lying land beyond; (11) S.Y. *Sapphire* under Mount Beerenberg; (12) S.Y. *Sapphire* under the Wille glacier.

Rhodesia. **Clark.**

One hundred and one photographs of Rhodesia, taken by Percy M. Clark, Esq. *Presented by Percy M. Clark, Esq.*

As mentioned in the *Geographical Journal* for December last, Mr. Clark has previously presented to this Society some excellent photographs of the Victoria falls. He has now added the following to that set, and amongst the views are some of exceptional interest, especially those of the falls themselves.

(1–37) Victoria falls; (38–41) The Zambezi bridge: (42–45) Views of the Zambezi river; (46) Tree on which Dr. Livingstone cut his initials in 1855; (47) King Lewanika; (48) King Lewanika's state barge; (49) Group of Mashukulumbwe, North-western Rhodesia; (50) The grave of Cecil Rhodes; (51 and 52) The gorge 5 miles below the Victoria falls; (53 and 54) First descent of gorge on south bank, February, 1904, by C. Beresford Fox and Percy M. Clark; (55) Looking upwards from quarter-way down the gorge; (56) Bridge when linked up; (57 and 58) Electric Blondin used for Zambezi bridge construction; (59) Steam Blondin; (60) Photographing the Victoria falls from Livingstone island; (61) Batoka type of hair-dressing; (62) Landing-place, Sesheke; (63) At Sesheke; (64) Dug-outs, Sesheke; (64–69) Dug-outs, upper Zambezi; (70) Papyrus, on the banks of the Zambezi; (71) Palms; (72) Cupping a native with ram's horns; (73) An island in the upper Zambezi; (74) Narrowest point on the upper Zambezi, between Victoria falls and the Ngonye falls; (75) Hippo head; (76) Giraffe in bush; (77 and 78) On the upper Zambezi; (79 and 80) An upset in the rapids, Kasangulu; (81) The creek, Kasangulu; (82) On the way to the Victoria falls; (83 and 84) The Zambezi coach, 1903; (85) Native carrier near Bulawayo; (86) Rhodes' huts, Matoppos; (87) Usual method of working, Barotseland; (88) Quinani, a Barotse chief; (89) Blacksmith; (90) A Barotse hut; (91) Barotse dancing-mask; (92) Barotse native; (93) A native church, Barotseland; (94) Hut-building.

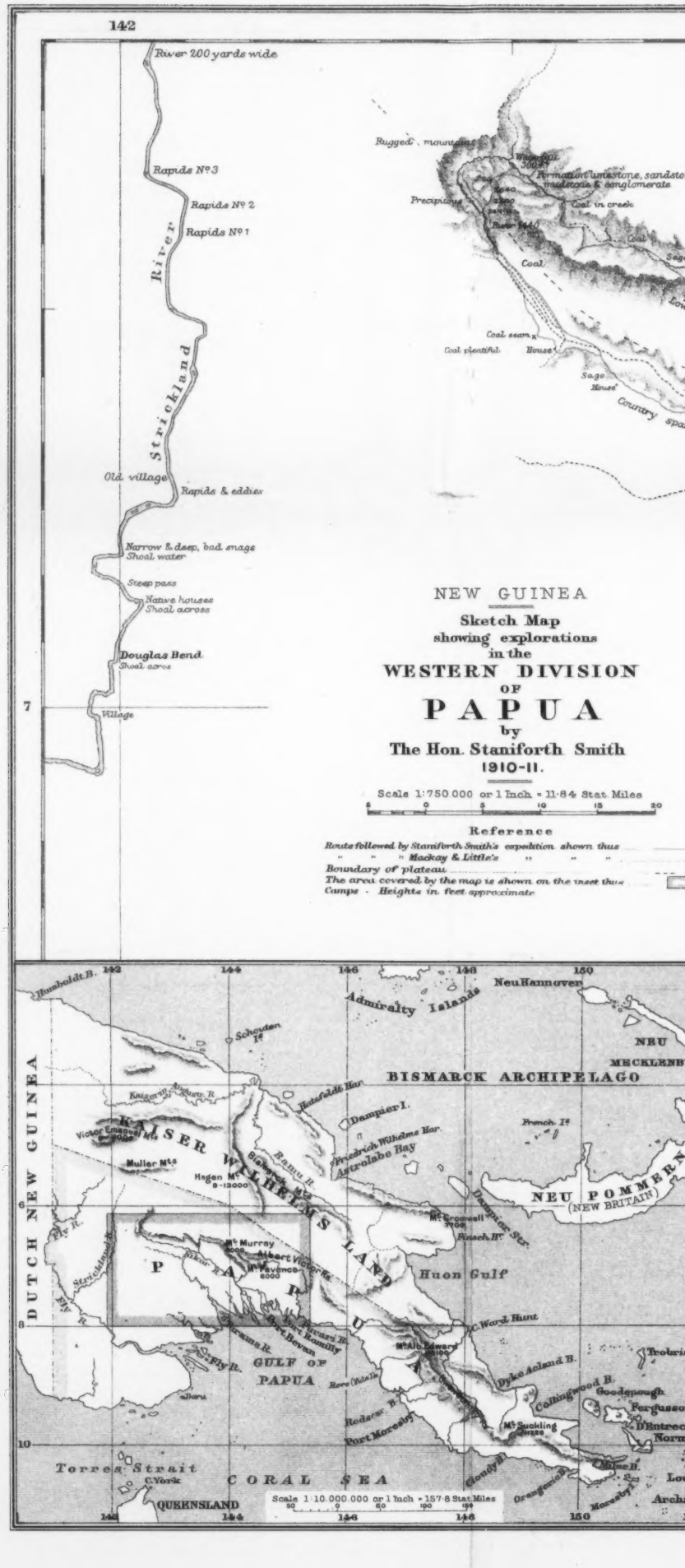
Syria. **Bonfils.**

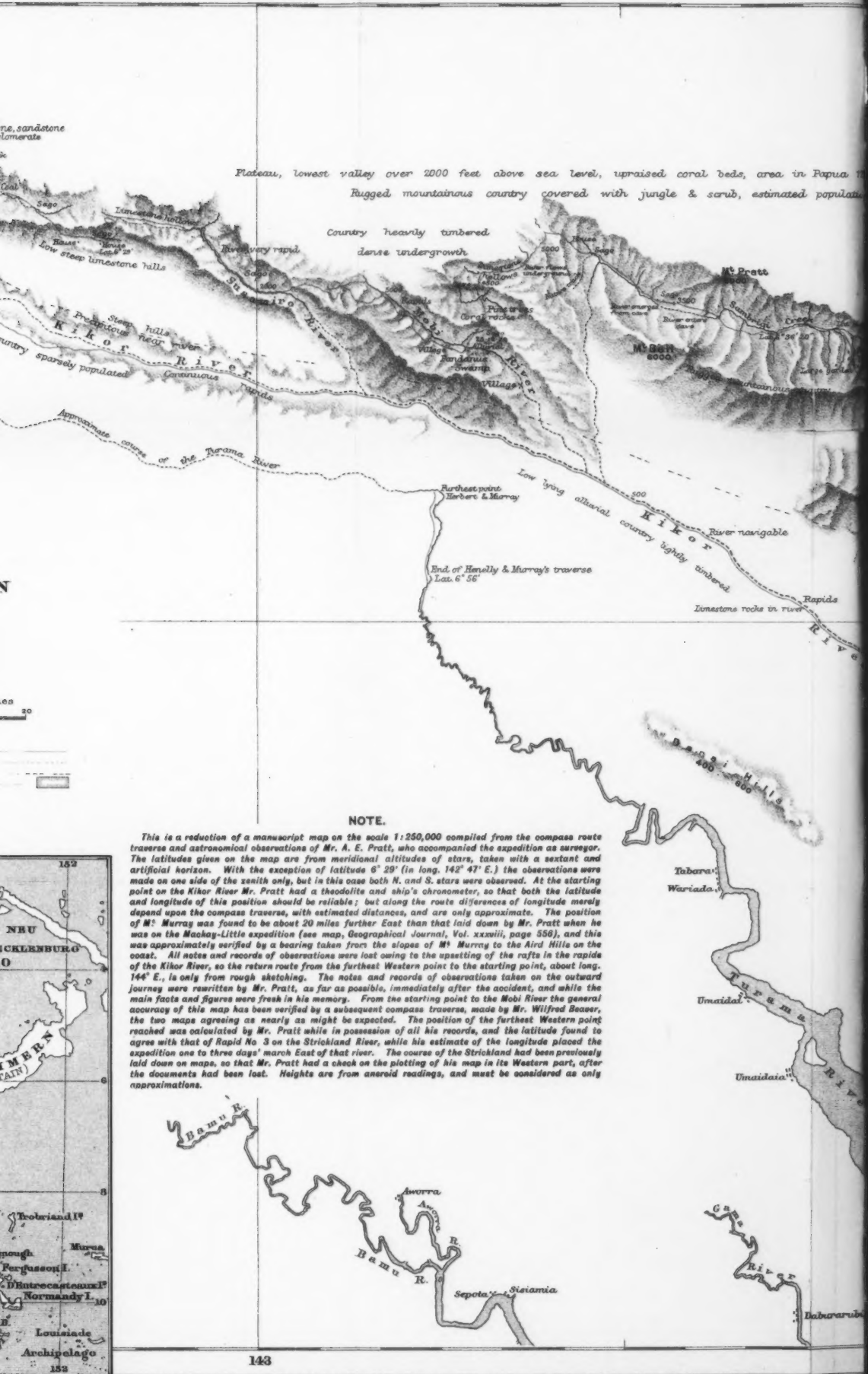
Twelve photographs of the Ruins of Baalbek, Damascus, and Cedars of Lebanon, taken by M. Bonfils. *Presented by E. M. Tabor, Esq.*

The remarkably fine photographs of the ruins of Baalbek and their surroundings are worthy of special attention. They measure 8½ inches by 11 inches.

(1) Capitals at Baalbek; (2) Columns of the Temple of the Sun; (3) Temple of Venus; (4) Interior of the Temple of Jupiter; (5) Sculpture round the central basin; (6) A leaning column; (7) Fluted columns of the pronaos of the temple; (9) General view of the fortress of Damascus; (10) General view of the forest of the cedars of Lebanon; (11) General view of Baalbek ruins; (12) No title.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


142
River 200 yards wide
Rapids Nº 3
Rapids Nº 2
Rapids Nº 1
River Strickland
Old village
Rapids & eddies
Narrow & deep, bad snags
Shoal water
Steep pass
Native houses
Shoal across
Douglas Bend
Shoal across
Village
7
Rugged mountains
Precipitous
Coal in creek
Coal
Coal seam
Coal plentiful
House
Sago
Country spa
NEW GUINEA
Sketch Map
showing explorations
in the
WESTERN DIVISION
OF
PAPUA
by
The Hon. Staniforth Smith
1910-11.
Scale 1:750.000 or 1 Inch = 11·84 Stat. Miles
Reference
Route followed by Staniforth Smith's expedition shown thus
" " " Mackay & Little's " " "
Boundary of plateau
The area covered by the map is shown on the inset thus
Camps · Heights in feet approximate
DUTCH NEW GUINEA
KAISER WILHELMS LAND
PAPUA
BISMARCK ARCHIPELAGO
Admiralty Islands
Neu Hannover
NEU POMMERN
(NEW BRITAIN)
Huon Gulf
GULF OF PAPUA
Torres Strait
CORAL SEA
QUEENSLAND
Port Moresby
Scale 1 10.000.000 or 1 Inch = 157·8 Stat. Miles
142
144
146
148
150
6
8
10



NOTE.

This is a reduction of a manuscript map on the scale 1:250,000 compiled from the compass route traverse and astronomical observations of Mr. A. E. Pratt, who accompanied the expedition as surveyor. The latitudes given on the map are from meridional altitudes of stars, taken with a sextant and artificial horizon. With the exception of latitude 6° 29' (in long. 142° 47' E.) the observations were made on one side of the zenith only, but in this case both N. and S. stars were observed. At the starting point on the Kikor River Mr. Pratt had a theodolite and ship's chronometer, so that both the latitude and longitude of this position should be reliable; but along the route differences of longitude merely depend upon the compass traverse, with estimated distances, and are only approximate. The position of Mt Murray was found to be about 20 miles further East than that laid down by Mr. Pratt when he was on the Mackay-Little expedition (see map, Geographical Journal, Vol. xxxviii, page 556), and this was approximately verified by a bearing taken from the slopes of Mt Murray to the Aird Hills on the coast. All notes and records of observations were lost owing to the upsetting of the rafts in the rapids of the Kikor River, so the return route from the furthest Western point to the starting point, about long. 144° E., is only from rough sketching. The notes and records of observations taken on the outward journey were rewritten by Mr. Pratt, as far as possible, immediately after the accident, and while the main facts and figures were fresh in his memory. From the starting point to the Mobi River the general accuracy of this map has been verified by a subsequent compass traverse, made by Mr. Wilfred Beaver, the two maps agreeing as nearly as might be expected. The position of the furthest Western point reached was calculated by Mr. Pratt while in possession of all his records, and the latitude found to agree with that of Rapid No. 3 on the Strickland River, while his estimate of the longitude placed the expedition one to three days' march East of that river. The course of the Strickland had been previously laid down on maps, so that Mr. Pratt had a check on the plotting of his map in its Western part, after the documents had been lost. Heights are from aneroid readings, and must be considered as only approximations.

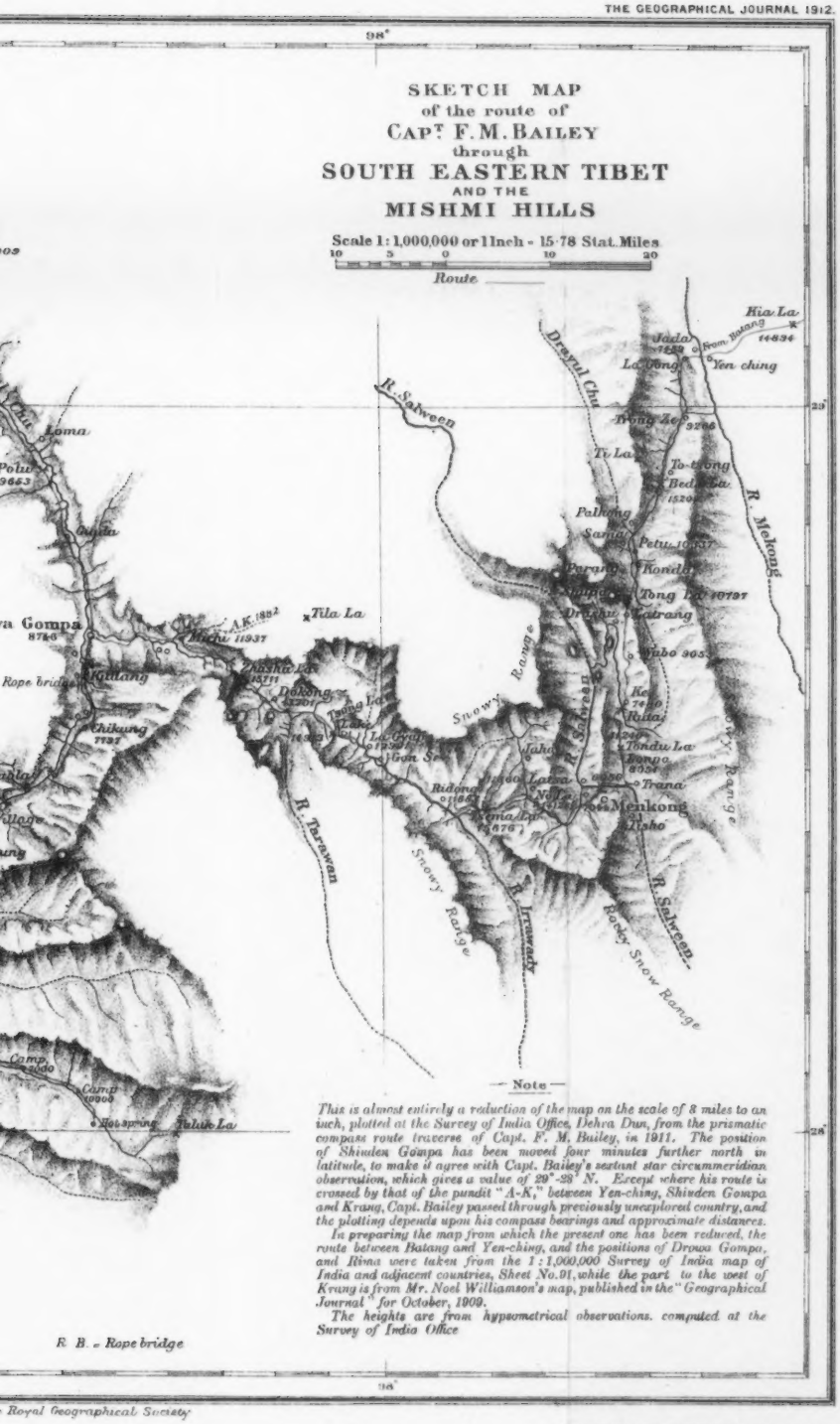
Published by the Royal Geographical Society.

Papua 12,000 square miles.
population 15,000.
Mt Murray
Amy Range
Crummer Peaks
Udi R.
Coal
Rapids
Coal.
Rapids
Recent alluvial
Sireba R.
Omati River
Naimesse
Morigio I.
Neabo I.
DELTA OF TURAMA RIVER
Gawai Mouth
Baia-o
Aidia
Warual
Upua
Otoai
Goaribari I
DELTA OF AIRD RIVE
Ihibubari I.
Saumao
Port Bevan
C. Blackwo
G U L F o
144

145
KAISER WILHELMS
LAND
GERMAN NEW GUINEA
Macgregor Peaks
4000
Mt Musgrave
Mt Favenc
4000
Glasson I.
Chalmers I.
Ivo
Bevan Mt
Mafkikiria
River
Mt Dowall I.
Nalapo Is.
Bevan Rapid
Abukairu I.
Kapaina River
Pie R.
Baroi R.
Kairu R.
Puiari R.
Ini I.
Paia Inlet
Bay
Deception B.
Baimuru
Bapai R.
Port Romilly
Bald Head
Hvarra
Wame R.
Karika
Kaimare Villages
PURARI DELTA
Aivi R.
Pasarua
Baroi R.
Urika R.
Maipua
Apiopa
Aivi Passage
Alele Passage
Orokolo
D RIVER
C. Blackwood
O F P A P U A
145

PAPUA.
Smith.

97°
Ngam Tso
Shiuden Gompa 13885
Dama La
Rugo 15096
Yo le La 16307
Poda 14322
Shukiratha
Deedan
Sanga Chu
Gochen 10802
Ata La
Zayul Chu
Drowa Gomp
Rope brid
Village
Lanka
Machang
Rima
Rope brid
Camp
Rope bridge
Rope bridge 3305
Mungo
Rope bridge
Kahap
Tong
Tanne
Yarti
Tulung
Samung
Trunuta
Minyang 2813
Kupa
Sakumgam
Tushaum
Panqum
Hkamti
Hkamti Long
Tibet
Lhasa
R. Brahmaputra or Tsang Po
Shiuden Gompa
Punatang
Yen ching
Chiamda
Batang
Litang
Tachien-lu
Ya chou Fu
Cheng tu
Rima
Menkong
Sadiya
Dibrugarh
Darjeeling
Sikkim
Bhutan
China
Assam
Burma
Mritkyinai
Teng yueh
Bhamo
Yun nan Fu
Lashio
Mandalay
Tropic of Cancer
Calcutta
Scale 1: 32,000,000 or 1 Inch = 315·6 Statute Miles
Published by the Royal Geog

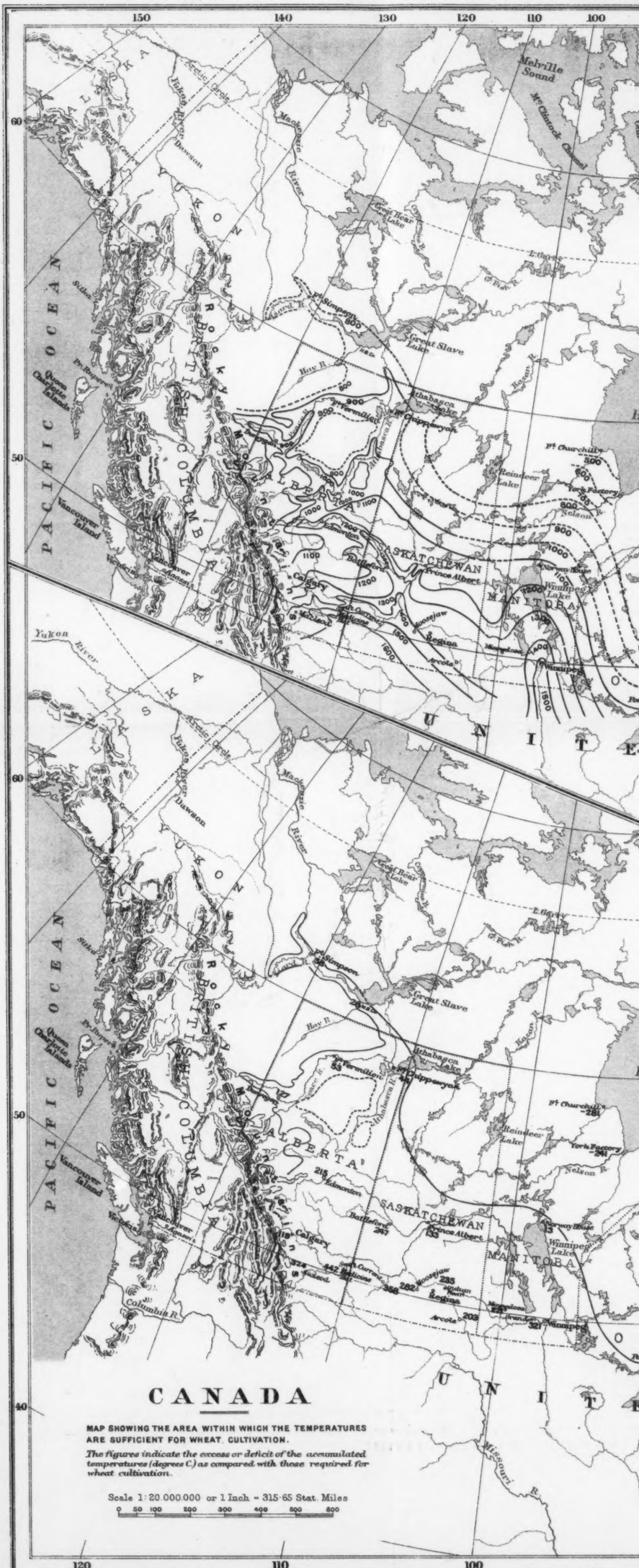

98°
SKETCH MAP
of the route of
CAPT. F. M. BAILEY
through
SOUTH EASTERN TIBET
AND THE
MISHMI HILLS
Scale 1: 1,000,000 or 1 Inch = 15·78 Stat. Miles
10 5 0 10 20
Route
Hia La
Jada
From Batang
Yen ching
La Dong
Drowul Chu
R. Salween
Dong Ze
Ti La
To-dong
Bed La
R. Mekong
Palkong
Petru
Rondal
Tong La
Drakbu
Tabo
Snowy Range
Ritai
Tondu La
Trana
Menkong
Tsho
R. Tarawan
R. Irrawady
R. Salween
Rocky Snow Range
Tila La
A.K.
Michu
Zhaska La
Dakong
Chikung
Gompa
Rope bridge
Camp
Camp
Hot spring
Yalung La
Note
This is almost entirely a reduction of the map on the scale of 8 miles to an inch, plotted at the Survey of India Office, Dehra Dun, from the prismatic compass route traverse of Capt. F. M. Bailey, in 1911. The position of Shiuden Gompa has been moved four minutes further north in latitude, to make it agree with Capt. Bailey's sextant star circummeridian observation, which gives a value of 29°-23' N. Except where his route is crossed by that of the pundit "A-K," between Yen-ching, Shiuden Gompa and Krang, Capt. Bailey passed through previously unexplored country, and the plotting depends upon his compass bearings and approximate distances.
In preparing the map from which the present one has been reduced, the route between Batang and Yen-ching, and the positions of Drowa Gompa, and Rivna were taken from the 1:1,000,000 Survey of India map of India and adjacent countries, Sheet No. 91, while the part to the west of Krang is from Mr. Noel Williamson's map, published in the "Geographical Journal" for October, 1909.
The heights are from hypsometrical observations, computed at the Survey of India Office
R. B. = Rope bridge
28°

Royal Geographical Society

SOUTH EASTERN TIBET
AND THE MISHMI HILLS
BAILEY.

To illustrate

CLIMATIC LIMITS OF WHEAT C



Bonne's Modified Conical Equal Area Projection

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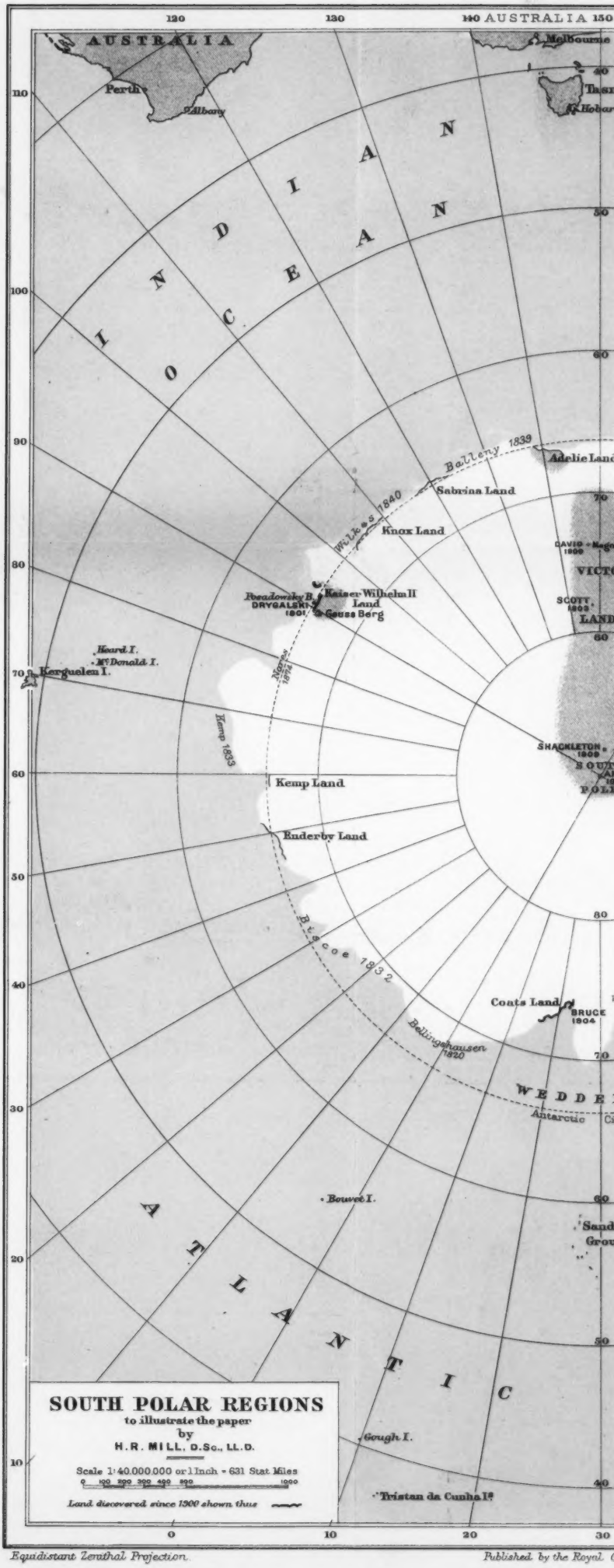
CANADA
Unstead.



Equidistant Zenithal Projection.

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I A 150
160
170
180
lbourne
Tasmania
Hobart
Anckland
NEW
ZEALAND
Wellington
Port Lyttelton
Stewart I.
Chatham I.
Auckland I.
Bounty I.
Macquarie I.
Campbell I.
Antipodes I.
elie Land
Ballery I.
Scott I.
c. North
Cape Adare
SOUTH
Possession I.
Coulman I.
VICTORIA
Ross Sea
Ross 1842
Ross I.
LAND
Ice Barrier
SCOTT
1902
King Edward VII Land
Cook 1773
SOUTH
AMUNDSEN
1911
POLE
CHARCOT
1910
Peter I.st I.
Charcot Land
Alexander I. Land
Fallières Land
Adelaide I.
Graham Land
Biscoe Is.
Palmer Archipelago
South
Shetland Is.
Elephant I.
South Orkney Is.
Cape Horn
Staten I.
Magellan St.
Sandwich
Group
Falkland Is.
South Georgia
Valparaiso
Buenos Aires
Rio de la Plata
Montevideo
SOUTH
AMERICA
OCEAN
BELLINGSHAUSEN SEA
Weddell 1822
BRUCE
1904
SEA
Circle
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30